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Identification of Peak Hours of Noise Pollution at Sensitive Locations of Kasaragod District: Impact, Analysis and Control Measures

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Abstract: Noise derived from latin word nausea which means annoyance is a silent killer. The present study has focussed on noise measurement on the highway sides from Kanhangad to Kasaragod town premises. A representative data from Kanhangad district hospital area and Kanhangad town area has been taken for the measurement and analysis. Sound level measurement is carried out using the Sound Level Meter (SLM) application installed in Redmi 5s prime mobile phone. The study also aims to create an awareness about noise pollution and its serious effects among the public and to issue guidelines for proper management of noise through vegetations, sound proofing barriers, automatic door systems, noise barriers on the walls and imposing strict rules to control the number of operating vehicles in the area.

Keywords: Noise, Sound Level Meter, Decibel, Noise Measurement.

I. INTRODUCTION

Any unwanted sound produced from industries, vehicles, institutions and the like are classified under the category of noise. The word noise is derived from latin word *nausea* which means *annoyance*. The so-called noise creates annoyance, sleep problems, hypertension and communication interference causing health problems and culminates human population by its silent killing approach [2]. The major sources of noise pollution are traffic, industries, construction works, religious places, public address systems etc. The noise pollution resulting from intense traffic has contributed to an enormous hike in the health-related issues in humans and animals. The presence of narrow streets and lanes supplemented with tall buildings creates a reverberating path for the noise to surround. According to Central Pollution Control Board (CPCB), sound levels of equal and more than 80 decibels (db) are stress producing. The results of noise pollution cause sleep disturbances which increases the heart rate and blood pressure, annoyance, lack of concentration in children leading to poor academics, hearing loss which may be temporary and permanent, elevated psychological stresses and obsessive-compulsive disorders, and increased accidents.

II. LITERATURE REVIEW

Debnath et al. [2], study the noise pollution around the academic premises of Assam and depict the ill effects of noise pollution in academics of teachers and students. The sound was measured using sound level meters and questionnaire approach was utilised to study the ill effects of elevated noise levels in the academic premises.

Awosusi and Akindutire [3] conduct a survey to investigate the level of awareness of the health issues based on the relation between health and location of noise in a prominent location of Nigeria. The study resulted in providing specific recommendations to the government organizations to provide stringent laws pertinent to control of noise pollution and control the noise emanating from industries via sound proofing technologies. In addition to strict tolerance to noise pollution, the health educators are also conceived with the data related to health issues emanating from noise pollution.

Garg et al. [4] show an increase in the noise levels by 82.9 % during a tenure of four years in 29 out of 35 locations across seven major cities in India. The data related to noise pollution were collected from a pilot study conducted by National Ambient Noise Monitoring Network (NANMN). The results of the study were displayed in the CPCB office at New Delhi. Noise pollution has health effect and the social aspects. Noise pollution also creates depression and a sort of annoyance among mental patients. The effect of noise pollution is felt equally by both males and females [12]. Aquatic noise poolution by the usage of sonars, seismic exploration and the like create morphological and behavioural changes in aquatic species [15]. The sources of noise pollution can be classified as natural and man-made. While bugs, weather and birds contribute to natural noise pollution, Industries, road traffic, rail traffic, aircraft, schools, religious institutions, hospitals and residentials contribute to man-made noise pollution. Jacyna et al. [9] discuss the problems with heavy traffic in roadways to develop sustainable practices in road transport systems using EMITRANSYS

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model. The evening, night and day sound levels were estimated using an Environment Noise Directive (END) for the European Union model as:

$$L_{den} = 10\ \log_{10}((\frac{1}{24})(12 * 10^{\frac{L_{day}}{10}} + 4 * 10^{\frac{L_{evening}+5}{10}} + 8 * 10^{\frac{L_{night}+10}{10}})) \quad (1)$$

Where:

L_{den} : day – evening – night noise level indicator.
L_{day} : average noise level in day time.
$L_{evening}$: average noise level in evening.
L_{night} : average noise level in night time.

Mutalib et al. [6] study the effect of road corridors in managing traffic noise pollution. The noise level in the area of study has been estimated as 75 db where the limit is 55 db. The study concludes the effect of noise with adaptive measures to control noise pollution via natural noise barriers like trees and sound proofing man-made structures.
Gonzalez et al. [7], study the effects of air and noise pollution in urban zones to show the relationship between air and noise pollution. Heavy traffic zones spikes both air and noise pollution contributing to type 2 diabetes, elevated cholesterol levels and cardio vascular diseases in humans. Driving at constant speeds at right gears, changing the gears at proper time, proper urban planning for planting big trees on road ways are effective measures to counteract noise pollution.
Bocher et al. [10], model noise using an open source GIS system to create noise maps for public information. The traditional GIS system integrated with open geospatial consortium standards makes easy computation of noise levels and synchronises with the population data. Maisonneuve et al. [13] suggest a noise tube technique to draw results using a low cost, participative and open access platform for assessing noise pollution. Hammer et al. [14] suggest public response system and redesign of buildings to cut short the effect of noise pollution on the US inhabitants which otherwise would have led to blockage of arteries resulting in cardiac damage.

III. METHODOLOGY

The study was based on collection of sound levels at various zones between Kanhangad and Kasaragod in Kasaragod district of Kerala India. A representative data from Kanhangad district hospital area and Kanhangad town area has been taken for the analysis. The sound level meter installed in REDMI mobile phone is used as measurement device.

A. *Noise data collection*

Sound level measurement is carried out using the Sound Level Meter (SLM) application installed in Redmi 5s prime mobile phone starting from 7.00 am until 1.00 am. The sound level meter is mounted on tripod closer to the noise source. SLM indicate as a sound pressure level (SPL) meter, decibel (dB) meter, noise meter or noise dosimeter. SLM use a microphone to capture the sound. The sound is then assessed within the device and sound measurement values are shown. The most common unit of sound measurement is decibel (db). It also can be permanently installed for constant monitoring of sound levels at a work or job site. The noise parameter is measured in LAeq.

B. *Permitted Noise levels in India*

In India, three major legislations cover the control of noise namely:

1. Factories Act, 1948
2. Motor Vehicles Act, 1988
3. Environment Protection Act, 1986 (Environment Protection Rules 1986 and Noise Pollution (Regulation and Control Rules 2000) [8]. The Central Pollution Control Board constituted a Committee on Noise Pollution Control. The Committee recommended Ambient standards in respect of noise for different categories of areas i.e. residential, commercial, industrial and silence zones which were later notified in Environment (Protection) Rules,1986 are shown in Table 1.

Table 1. Ambient standards in respect of noise for different categories of areas

Sl. No	Zone	Standards (db)	
		Day time	Night time
1	Industrial	75	70
2	Commercial	65	55
3	Residential	55	45
4	Silence	50	40
5	Educational institution	40 - 50	N.A

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C. ***Division of day duration***

In the present study, day time extends from 6 am to 5 pm. Evening time is from 5 pm to 10 pm. Night time continues from 10 pm to 6 am. The study was conducted on the highway sides from Kanhangad to Kasaragod town premises which includes hospitals, schools, colleges, bus stands and residential apartments. A representative data from Kanhangad district hospital area and Kanhangad town area has been taken for the analysis. The sound level meter application software installed in Redmi mobile phones were used for sound measurement. The objective of the first phase of the study is to identify the peak hours of noise pollution at various locations on the highway at Kanhangad town and Kanhangad district hospital. The second phase of the study proposes various noise eliminating and controlling measures. The study also aims to create an awareness about noise pollution and its serious effects among the public.

Phase 1: The objective of the first phase of the study is to identify the peak hours of noise pollution from Kanhangad district hospital area and Kanhangad town area.

Table 1. Intensity of noise levels for Day 1

	Day 1	**20-01-2020**	
	Location	**Kanhangad**	
	Time	**Sound level (db)**	
		District Hospital	**Bus stand**
AM	**7.00 - 8.00**	41.9	65.2
	8.00 - 9.00	57.1	78.2
	9.00 - 10.00	61.8	71.5
	10.00 - 11.00	60.1	69.6
	11.00 - 12.00	52.2	69.3
PM	**12.00 - 1.00**	60	70.1
	1.00 - 2.00	58.4	67.3
	2.00 - 3.00	67.5	73.2
	3.00 - 4.00	68.5	78
	4.00 - 5.00	71.2	72.6
	5.00 - 6.00	70.3	70.2
	6.00 - 7.00	66	68.8
	7.00 - 8.00	61.5	61.1
	9.00 - 10.00	50.6	57.4
AM	**12.00 - 1.00**	40.8	45.8

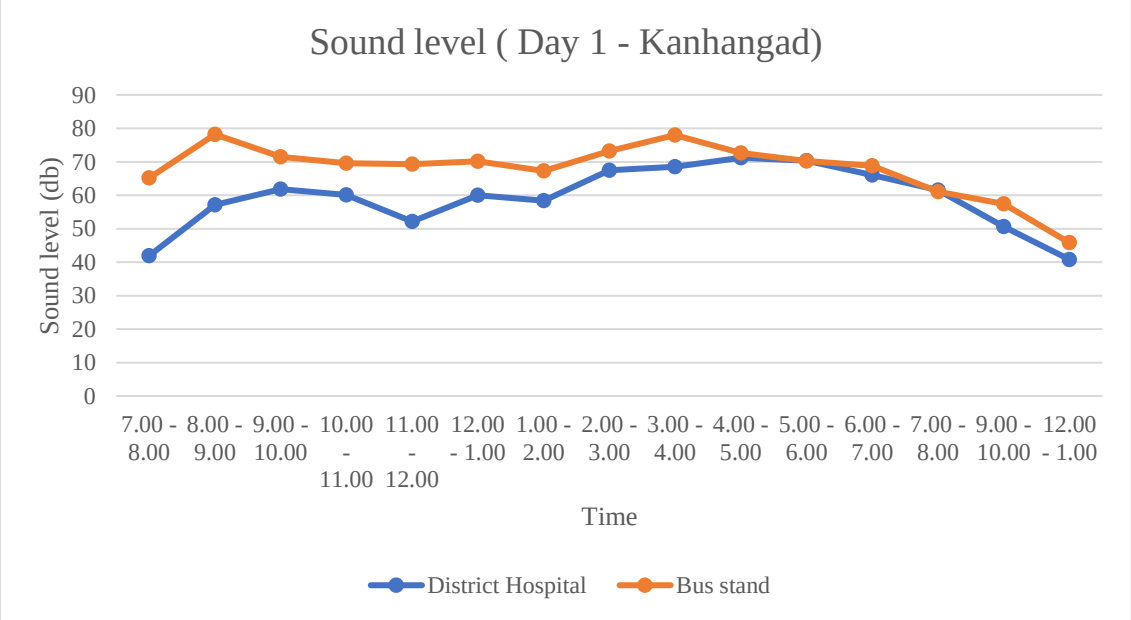

Figure 1. Sound level for Day 1

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The average noise level in the day-evening-night time is calculated using the END model as:

$$L_{den} = 10\ \log_{10}((\frac{1}{24})(12 * 10^{\frac{L_{day}}{10}} + 4 * 10^{\frac{L_{evening}+5}{10}} + 8 * 10^{\frac{L_{night}+10}{10}})) \quad (2)$$

L_{den} for day 1 = 64.273 db at the hospital premises.

Table 2. Intensity of noise level for Day 2

	Day 2	01-02-2020	
	Location	Kanhangad	
	Time	Sound level (db)	
		District Hospital	Bus stand
AM	7.00 - 8.00	41.2	64.5
	8.00 - 9.00	56.9	77.9
	9.00 - 10.00	61.1	65.3
	10.00 - 11.00	53.4	62.8
	11.00 - 12.00	55.8	61.4
PM	12.00 - 1.00	58.3	68.7
	1.00 - 2.00	48.2	66.8
	2.00 - 3.00	66.1	71.3
	3.00 - 4.00	67.8	77.1
	4.00 - 5.00	69.4	69.8
	5.00 - 6.00	67.9	68.3
	6.00 - 7.00	65.3	65.1
	7.00 - 8.00	59.3	59.4
	9.00 - 10.00	49.4	46.8
AM	12.00 - 1.00	45.2	44.5

L_{den} for day 2 = 62.688 db at the hospital premises.

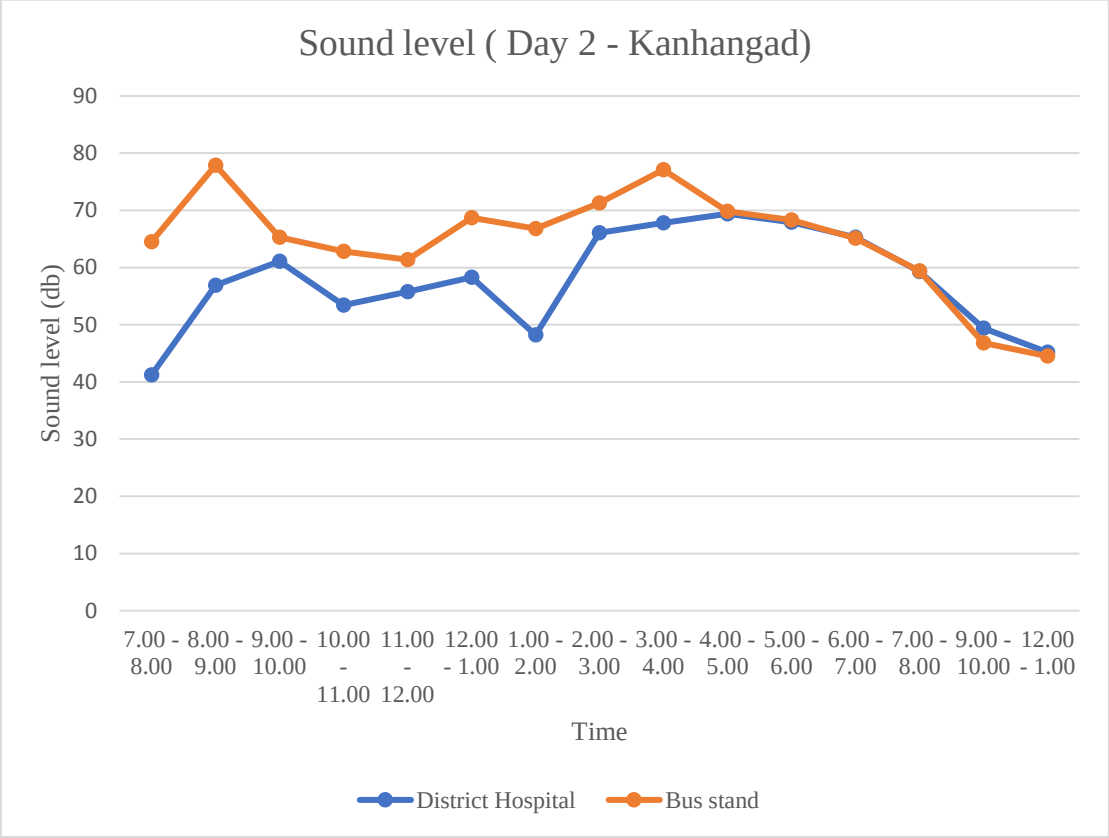

Figure 2. Sound level for Day 2

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According to CPCB, the permitted noise levels near hospitals should be fairly below 50 db. According to the survey conducted for the two specimen days, the day - evening - night average called as the L_{den} according to END falls above 60 db. For day 1 and 2, it has been found that the noise level surges above 60 db during 9.00 am to 10.00 am and from 2.00 pm to 6.00 pm. This is evident from Figure 1 and 2. The noise level drops below the acceptable limit during early morning i.e. 7.00 am to 8.00 am and during the late light from 12.00 am to 1.00 am. This is due to the fact that there are a smaller number of vehicles on the highway and a smaller number of people in the hospital premises. During the evening hours, the location is susceptible to heavy traffic, honking of vehicles, a greater number of people communicating in the premises and the like. The data specimens shown in the present study are limited to two days due to space constraints. The serious hike in sound levels in the premises of the hospital creates (1) annoyance in the patients and the health workers, (2) increased stress levels, (3) increased cardio vascular diseases, (4) hearing impairments in humans. The effects of increased noise levels are summarized in Table 3.

Table 3. Effects of increased noise levels in hospitals

Sl. No.	Specific environment	Critical health issue	Permitted sound level (db)
1	Hospital, ward rooms, indoors	Sleep disturbance, daytime and evenings.	30
2	Hospital, ward rooms, indoors	Sleep disturbance, night-time	30
3	Hospitals, treatment rooms, indoors	Interference with rest and recovery	As low as possible

According to Christensen [11], exposure to increased noise levels has attributed to slow healing wounds in patients, panic attacks, cardio vascular problems, increased anxiety levels in patients and the like. Hence proper controlling of noise levels should be done so as to maintain a healthy environment in the hospital premises. The following are suggestions to control the noise levels in the hospital premises.

- Trees acts as natural sound barriers. Therefore, plant a greater number of trees on the highway sides for a sustainable future.
- Installation of sound proofing barriers and automatic door system at the entrance of the hospital is a more promising way to reduce the effect of noise pollution to the inhabitants.
- Installation of noise barriers on the walls of the hospitals not only provides an aesthetic appearance but also cuts down the effect of noise pollution.
- Government should impose strict rules to control honking at hospital premises and limit the number of vehicles passing via hospitals.

Kanhangad town area is considered to be a sensitive zone owing to the presence of session court, schools, colleges, ashrams, temples and residences. According to CPCB, the permitted noise levels near sensitive areas should be fairly below 55 db. According to the survey conducted for the two specimen days, the day - evening - night average called as the L_{den} according to END falls above 65 db. For day 1 and 2, it has been found that the noise level surges above 77 db during 8.00 am to 9.00 am. The noise level drops below the acceptable limit during the late light from 12.00 am to 1.00 am. This is due to the fact that there are a smaller number of vehicles on the highway and a smaller number of people in the town premises. During the evening hours, the location is susceptible to heavy traffic, honking of vehicles, a greater number of people communicating in the premises and the like. The data specimens shown in the present study are limited to two days due to space constraints. The following are suggestions to control the noise levels in the town premises.

- Trees acts as natural sound barriers. Therefore, plant a greater number of trees on the highway sides for a sustainable future.
- Installation of sound proofing barriers and automatic door system at the entrance of the institutions is a more promising way to reduce the effect of noise pollution to the inhabitants.
- Installation of noise barriers on the walls not only provides an aesthetic appearance but also cuts down the effect of noise pollution.
- Government should impose strict rules to control honking at town premises and limit the number of vehicles entering and operating in the town area.
- The space area of the town is very small and causes the noise to reverberate. Hence measures should be taken to shift the bus stand from the most commercial areas in the town.

IV. CONCLUSION

The study was conducted on the highway sides from Kanhangad to Kasaragod town premises which includes hospitals, schools, colleges, bus stands and residential apartments. A representative data from Kanhangad district hospital area and Kanhangad town area has been taken for the analysis. Sound level measurement is carried out using the Sound Level Meter (SLM) application installed in Redmi 5s prime mobile phone starting from 7.00 am until 1.00 am. The objective of the first phase of the study is to identify the peak hours of noise pollution at various locations on the highway at Kanhangad town and Kanhangad district hospital. The second phase of the study proposes various noise eliminating and controlling measures. The study also aims to create an awareness about noise pollution and its serious effects among the public. According to CPCB, the permitted noise levels near hospitals should be fairly below 50 db. According to the survey conducted for the two specimen days, the day - evening - night

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average called as the L_{den} according to END falls above 60 db. For day 1 and 2, it has been found that the noise level surges above 60 db during 9.00 am to 10.00 am and from 2.00 pm to 6.00 pm. Kanhangad town area is considered to be a sensitive zone owing to the presence of session court, schools, colleges, ashrams, temples and residences.

According to CPCB, the permitted noise levels near sensitive areas should be fairly below 55 db. According to the survey conducted for the two specimen days, the day - evening - night average called as the L_{den} according to END falls above 65 db. Continuous exposure to increased noise levels attributes to slow healing wounds in patients, panic attacks, cardio vascular problems, increased anxiety levels in inhabitants and the like.

Proper management of noise can be done through proper planning by planting more vegetations, installing sound proofing barriers and automatic door system at the entrance of the institutions, installing noise barriers on the walls, imposing strict rules to control the number of operating vehicles in the area.

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BIOGRAPHY

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