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Noise Pollution Monitoring at Kolhapur Central Bus Stand

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Abstract - *Noise pollution is the term for unwanted sound, and it needs to be minimized to provide a comfortable working atmosphere. This chapter does a mathematical examination of noise and examines the effects of several sources. When two noises are joined and have the exact same intensity, the combined noise level can be 3 dB greater than the separate values.*
Two strategic transportation system locations were chosen for this study in order to assess the interior and outside areas. Twelve hours of the day, the noise level was measured every five minutes using the Lutron company Electronics Digital Sound Meter Model SL-4010 to assess the noise (the central Bus Stand Inside and the central Bus Stand Outside).

The quantity of noise pollution caused by vehicular traffic flow was calculated by measuring the sound levels in dBA every five minutes. After that, data were analysed every 45 minutes to evaluate the noise levels at each of the selected locations. The volume of traffic and the intensity of the noise are studied. Evaluation is done on the sound level factors L max, L min, L10, L50, L90, and Leq.

Key Words: **Noise Pollution, Central Bus Stand, traffic noise, SL-4010**

1.INTRODUCTION

The impact of noise pollution on human health and well-being has gained recognition in recent times, leading to further research into its levels and detrimental effects by scientists and interested global organizations like the World Health Organization (WHO). Environmental noise is a term used to describe one of the most common contaminants found in community noise. According to the World Health Organization, it is noise produced by all community activities excluding industrial areas. These activities include, but are not limited to, transport, air traffic, learning, building, government work, recreation, and community.

Traffic noise is one of among the most significant types of noise in comparison to other noises. The four main categories of traffic noise are noise from roads, airports, trains, and buses. Road traffic noise pollution causes physiological and psychological harm to people in addition to irritation, loss of concentration, and decreased productivity at work. The intensity of road traffic noise also rises geometrically in proportion to advancements in technology and the economy.

Recently, it has been determined that one of the main environmental factors affecting living standards worldwide, especially in cities, is environmental noise pollution.

When human activities like transportation, industry, & urbanization increase significantly, environmental levels of noise pollution rise quickly over time. The majority of urban population is forced to shift to quieter secondary roadways away from noisy generators due to the negative effects on human wellness and comfort. Noise is "unwanted sound" or "sound that is loud, unpleasant, or unexpected." The word noise comes from the Latin word "nausea."

1.1 Noise Applicability

The detrimental impacts of noise pollution affect millions of people. Studies have indicated a direct link between sound pollution and health problems. Disorders connected to stress, high blood pressure, speech difficulties, hearing loss, restless nights, and reduced productivity are among the problems caused by noise. Noise levels greater than 55 DB can cause conditions such as heart Failure and hypertension. For more than 50 years, Cirrus Research has been supplying user-friendly acoustic monitoring devices to organizations all around the world in an effort to protect people and the environment from noise. "Noise monitoring" is the methodical process of measuring, recording, and assessing sound levels in various contexts to ascertain the level of noise pollution and its potential consequences on the ecosystem and public health.

According to the tribunal, sound is far more than just a nuisance because it can lead to serious psychological distress. Still, there is a lack of application of the legislation. Noise from the environment is a major problem these days, especially in towns, and the main source of noise in towns is transportation noise. Because there are so many cars and other internal combustion engine vehicles on the road, road traffic noise is one of the main causes of noise pollution. Cities often have lower noise levels because electric and hybrid cars, which are gradually taking the place of gasoline-powered cars, typically have quieter engines. Other noises are also harmful to people and the environment. In this paper, we track and assess various noise sources and provide viable fixes for the impacted places.

1.2 Measurement of noise

Commonly used instruments for assessing noise pollution include loudspeaker meters and noise dosimeters. These devices provide useful information about noise levels and patterns in a particular area by measuring sound pressure in dB units. This is the method commonly used to quantify noise pollution. It's important to keep in mind that accurate measures of noise pollution require adhering to established methods and accounting for factors including the type of sound, the time of day, as well as the sensitivity of the receiving environment. Interpreting noise data may also involve assessing potential health impacts and the specifics of the sound source. In order to quantify noise pollution, one must use specialized equipment known as noise dosimeters and sound levels to measure the volume of sound in a particular space.

In order to quantify noise pollution, one must use specialized equipment known as noise meters or sound level meters to measure the volume of sound in a particular space. This is an illustrated description of the typical noise pollution monitoring process. Choose the appropriate instrument based on the specific requirements of the measurement. Sound level meters are frequently used for spot measurements, although people can wear sound dosimeters to monitor their exposure over time. Adjust the measurement device's calibration as instructed by the manufacturer. An essential step in ensuring the accuracy of the instrument is calibration. Configure the instrument's parameters, including the measurement period, frequency weighting (usually A-weighting to account for background sound), and any other special needs.

2. Bus Noise

Two examples of meteorological conditions that could have an impact on noise measurements and the propagation of sound waves are temperature and wind. For example, wind can carry sound distant from the instrument's location. Different locations may have different policies and practices for documenting and reporting loudness. Investing in high-quality sound testing equipment could be expensive. Thorough noise investigations could also require a lot of resources, like sophisticated tools and knowledgeable personnel.

It is essential to use appropriate and calibrated measurement tools, consider the context of the measurements, and adhere to relevant standards. Bus noise is the noise produced by buses if they are moving. Apart from external factors such as roadways and congestion, there exist several sources of noise associated to buses.

2.1 CPCB standards

These guidelines provide acceptable thresholds for air pollution levels and noise levels in certain land-use zones. They are designed to shield the ecosystem and the health of the broader public from the damaging effects of pollution. For the most updated information on CPCB standards, see the official publications of the central pollution control body or make direct contact with them. Recall that guidelines can alter in reaction to fresh scientific discoveries and evolving environmental conditions. The noise monitoring data provided by CPCB, India, over the odd-even rules implementation, the festival of Diwali, and Sundays are also reviewed and contrasted with business-as-usual days.

Table -1: Noise standards by the Central Pollution Control Board, India (CPCB, 1998)

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

They may have important resources or information about Kolhapur-specific noise pollution standards. Additionally, keep in mind that noise pollution guidelines typically specify permissible noise levels for specific times of both day and night, as well as variations between various land-use areas, such as the commercial, residential, and industrial sectors.

2.2 EQUIVALENT NOISE LEVEL

Any fluctuating noise can be represented by the statistical value of the sound pressure level. Therefore, it is defined as a constant noise level that expands energy over a certain time similar to that which is produced by variations in it over the same time. Equivalent noise level is a measurement of the constant equivalent sound level throughout a specific time period. It provides an approach to represent a varying sound level in perspective of a single, constant level that would represent the same quantity of total noise energy all over the same duration of time. When a detailed representation of noise exposure is needed, like in workplace noise exposure assessments and environmental noise assessments, Leq is commonly used. The following are important details about Equivalent Noise Level: The square of the root of the end product is obtained by adding the squares of the A-weighted sound pressure over a specific time period to get the Leq. In mathematical terms, it can be expressed as the average root of the root square with the A-weighted sound pressure level over a given duration.

$$log = 10 \times log\ 10 \sum_{i=1}^{n} \left\{ \left(10^{\frac{L_i}{10}} \right) ti \right\}$$

where,

n =represents the overall amount of sound samples.

Li =Any ith sample's noise level

Ti =the ith sample's time length stated as a percentage of the sample's overall duration.

3. METHODOLOGY

The project's outcome is dependent on various types of data. Determine the variables influencing noise pollution. gathering of information about traffic parameters like volume, noise level, and composition.

1.Selected region survey.

2. Measure and research noise levels.

3. An analysis of the frequency of buses and trains in the research region.

4. How the local populace perceives the noise.

5. A survey with questions.

A manual monitoring system is employed for the traffic sound level study. The noise level was measured, and in addition, the traffic volume that are was counted. The first vehicle traffic from the stations was the cause of the noise in all four occasions.

1. Choosing a transportation hub.

2. The monitoring and evaluation of noise indices 1.10, 150, and 190 as well as comparable noise levels at various environmental areas, including the interior and outside of Kolhapur City's central bus stand and train station.
3. Gathering traffic data during holidays and celebrations.
4. Create a framework based on the field of research.
5. Examine the research area's mitigating strategies.

2.3 BASIC INSTRUCTIONS FOR USING AN AUDIO LEVEL METER

1. Set the noise level meter far enough away from any reflections or obstructions.
2. Set the sound level meter's microphone between 1.3 and 1.5 meters above the ground.
3. Point the sound level meter's microphone in the same direction of the sounds source.

2.4 CBS Interior Zone

Connections to many areas inside Kolhapur city as well as to neighbouring towns and cities are available from the Kolhapur Central Bus Stand, or CBS. Buses from Kolhapur Central Bus Stand often go to Pune, Mumbai, Belgaum (Karnataka), Ratnagiri, Goa, Sangli, Satara, Solapur, and Pune. These are only a few of the locations; many more might be available depending on the routes and amenities offered by different bus operators.

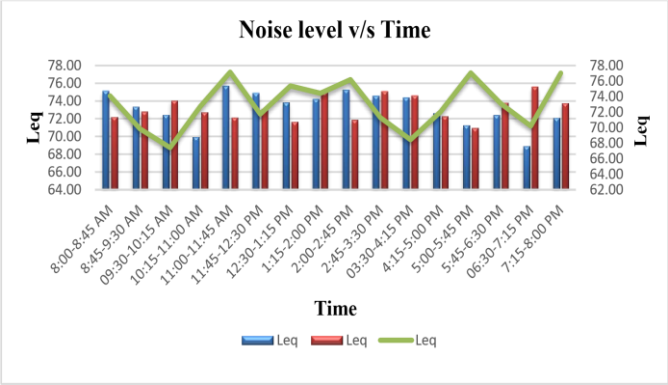

Chart -1: Noise level v/s Time at Kolhapur central bus stand interior zone

The main causes of the increased noise are the bus conditions; other sources include speakers, abrupt stops, announcements, passengers' chatter, and yelling vendors at the central bus stop area. The noise level is first reduced in the morning and then raised. At 11:00 and 11:45 a.m., the highest leq is 77.14 dBA, and it rises during peak hours. There is 78.79 dBA of noise. It then grew once more till between 7:15 and 8:00 p.m. There is 77.03 dBA of noise. And it drops until 8:00 p.m. once more. A minimum nasal level of 77.61 dBA is also required.

Fig -1: Kolhapur central bus stand interior zone

2.5 CBS exterior to the Region

Bus stands are typically surrounded by busy, noisy areas due to the continuous movement of traffic, pedestrians, and suppliers. The level of noise outside the CBS may be higher throughout peak times, such as early mornings and at night, while people are moving to and from work or when bus departures and arrivals are common. Additional factors that may contribute to higher noise levels include the time of the day, traffic volume, the presence of nearby businesses, and events that are taking place in the area.

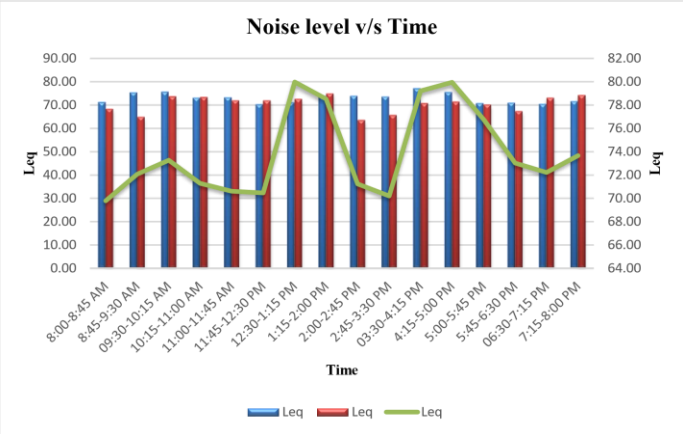

Chart -2: Noise level v/s Time at Kolhapur central bus stand exterior region

Consider taking preventative measures, such as soundproofing your house or place of business, donning earplugs or noise-cancelling headphones, or contacting the local government to learn about any efforts that they may be conducting to reduce the environmental damage caused by traffic noise, if you're concerned about noise from vehicles in the Kolhapur CBS area. elevates the volume of noise. In the afternoon, there are more cars on the mad, and there is more noise. At 12:30 p.m., the highest leq is 79.98 dBA. The noise level at 1:15 p.m. is 79.96 dBA. It then raised once again till 3 p.m. There is 73.66 dBA of noise. And it drops until 8:00 p.m. once more. Furthermore, the lowest nasal intensity is 63.52 dBA.

2.6 Material for a noise barrier

Effective noise barriers reduce the level of sound by 10–15 dB, which can cut the volume of road noise in half. Barriers can be constructed from high, high walls or the earth berms, which are the earthen mounds that run along the roads. Earth berms are a visually pleasing noise barrier because they produce an organic appearance while blocking vibrations from the road directly into nearby homes and businesses. They don't totally eliminate noise; they only minimize it. Regarding receptor impact, a noise barrier must be at least five dB quieter than the surrounding environment.

2.7 Bamboo Panel

Bamboo panel is a kind of the large genus Bamboo that belongs to the clumping bamboo tribe Bamboo. It usually grows in tropical and subtropical regions of Asia, especially in the wet tropics. When bamboo grows closer to one another, the noise control effects are better. This feasibility study shows that the noise-reducing impact of a bamboo noise barrier, measuring 5 meters in height and 6 meters in thickness, is roughly equivalent to that of a solid noise barrier, measuring three meters in height. Because bamboo naturally absorbs sound, it could be a helpful resource in this area. The natural characteristics of bamboo allow it to absorb some sound, however not as much as added specialized acoustic materials like fiberglass or foam panels insulation. Because of the porosity in its structure, sound waves

2.8 Characteristics of the Bamboo Panel

The low cost of Bamboo panels stems from its all-banana construction, which is one of their key features. Waste material is recycled and utilized to make scrap material, like bamboo poles. It reduces noise by about 5 to 10% in tests that are done indoors. Due to the lack of machinery, the panel requires very little maintenance. It is possible to effectively absorb high-frequency sound by using bamboo's hollow structure to reflect incoming sound waves. Bamboo makes great screens and hedges, but its dense foliage also functions well as a noise barrier, windbreak, and hedge. This feature is becoming more and more common in areas where organic bushland is disappearing and highway traffic is increasing.

2.9 Holes in Bamboo Panel (Full Bamboo Poles)

Table -1: Test findings for the panel of Bamboo

No	LEQ source dB	LEQ receiver dB	dB Reduction Leq source - Leq receiver	Reduction in Percentage
1	73.1	67.1	6.0	8.21
2	74.8	69.9	4.9	6.55
3	78.8	70.5	8.3	10.53
4	82.5	74.6	7.9	9.58

Fig -2: Bamboo Panel with full bamboo poles

In a lab, the aforementioned test was conducted. The test's findings show that Bambusa vulgaris reduces noise levels by about 5.7 dB. This value is the average of the four test results given before. This proves that Bamboo makes noise perceptible by reducing it by 6% to 10%.

Graphical representation of test data:

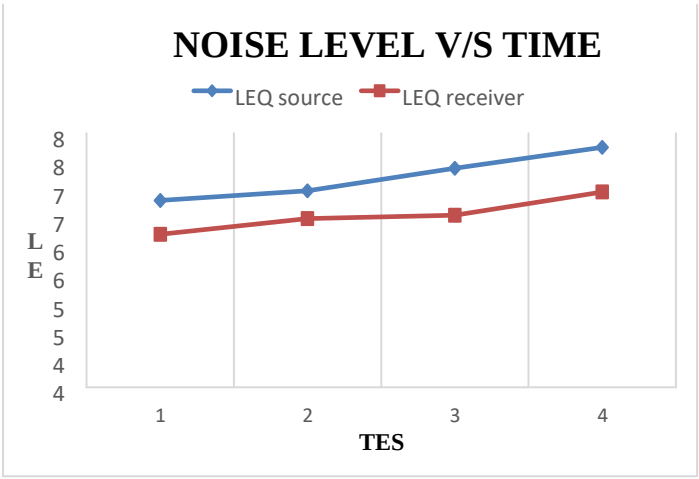

Chart -2: LEQ v/s Leq source dB and Leq receiver dB

3. CONCLUSIONS

In order to create a sound absorption model for Kolhapur City's central bus stand and to provide possible noise mitigation techniques for the impacted area by utilizing sound equivalents, this study will track and evaluate the noise level within and outside of both platforms. Additionally, it will detect sound levels during holidays and celebratory days. The primary bus terminal in Kolhapur provides information on all the traffic and noise within and beyond the city.

1. Build barriers composed of brick, concrete, or specifically designed acoustic panels around the bus stand to stop noise from echoing into the surrounding regions.

2. Use sound-absorbing materials when constructing or remodelling the bus stand. These could include wall panels, ceilings, and flooring that have been carefully constructed to reduce noise transmission.

3. Plant dense greenery along the bus stop's perimeter. The natural absorption and deflection abilities of plants and trees can be used to reduce noise levels in an environment.

4. To minimize the number of vehicles that are idle or operating simultaneously, bus arrivals and departures should be spaced apart. This will reduce noise levels overall.

5. Gradually convert to electric or hybrid buses, which are considerably quieter than diesel-powered buses. Examine the use of sound waves in conjunction with active sound control technology to eliminate unwanted sounds in particular areas.

6. When electric buses replace diesel ones in the city, there is less noise. The overall public's well-being and pollution levels are improved by electric buses because they don't produce any exhaust emissions.

7. Over time, fuel and maintenance costs for electric buses can be reduced in comparison to diesel buses. The town's carbon footprint is reduced and sustainable growth objectives are fulfilled by utilizing electric buses.

8. Within the bus stand, lower speed limits must to be introduced and maintained in order to reduce noise from engines and braking.

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