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Vehicular Sound and Its Consequence on Sound Pollution in Industrial and Commercial Zone of Sylhet City

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Abstract

Automobile vehicles, a vital component of the urban environment, are also the main contributory factor of urban sound pollution. It is one of Sylhet zone's most significant contributors to noise pollution. Sylhet is one of the most Bangladeshi cities with the speediest growth. The amount of transportation facilities (the number of automobiles) is growing along with population growth. In Sylhet city, noise pollution has been rising alarmingly. Noise refers to sounds that occur around us but are not a part of the environment under study. For this reason, during working days, between 6 am and 12 am, noise levels were supervised at 10 major places (Industrial Zone and Commercial Zone) throughout the city. The paper focused on the consequences of sound in the industrial and commercial zones of Sylhet City based on vehicular sound impact. The basic method of counting traffic was automatic recording. In addition, a sound level meter was used to record the sound volume at intervals of three hours. Implementing the passenger car unit (PCU) conversion factor, the data were calculated based on the 60-minute average of vehicle movements that crossed the location. "Environmental Conservation Rules-1997" was regarded as fundamental to analyzing the data. The sound level was higher than the allowed noise standard in all the selected industrial and commercial locations. It also demonstrated the influence of traffic clatter. Most of the time, the sound level at each site stayed persistently higher than the allowed range, and vehicular activity played a substantial role in each case.

Keywords: *Pollution; Traffic; PCU; Industrial zone and commercial zone.*

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Introduction

The term noise refers directly to the Latin meaning of "nausea." A definition of noise could be the unsuitable size at the incorrect moment and situation. The rapidly increasing populations, transportation overload, and commercial-industrial activity increase noise pollution. For those reasons, major cities worldwide are presently experiencing increased noise pollution. It has been demonstrated that extreme noise not only harms the well-being of humanity but also causes a physical condition risk to all species of life; massive amounts of noise impact even objects that are not [1]. In Bangladesh, noise pollution poses a severe health danger because of sound pollution. Millions of residents in Bangladesh face the risk of a range of health concerns.

Vehicles are regarded to be the most significant contributors to generating pollution in cities. Around the globe, pollution from sound has been suspected of creating significant risks to people's standard of living. Noise substantially influences the standard of living [2]. The capability of being heard frequency ranges from 20 to 20,000 hertz [3]. Noises with levels less than 20 hertz are identified as infrasonic, as opposed to noises with levels at or above 20,000 hertz are described as ultrasonic. Waves of sound are a specific kind of "chain reaction" circulation that remains till the molecules' energy moves away. Individuals' mental and physical behavior is affected by noise pollution. It can induce gastrointestinal suffering, hypertension, arterial disease, coronary artery disease, insomnia, agitation, sadness, exhaustion, allergies, emotional tension, and dissatisfaction [4]. Experts warn that if a child under three hears a horn generating 100 decibels of chaos within close distance, it could damage their hearing [5]. Noise in Sylhet City affects hundreds of children's hearing daily, particularly for kids; the horns (from vehicles) are quite harmful. The typical person cannot sleep when subjected to 45 dB of noise; hearing loss begins at a slightly lower volume, about 85 dB, and progresses to around 120 dB [6].

Sylhet is one of the most prominent blessed cities of Bangladesh. Sylhet City Corporation, which has an area of 26.50 square kilometers, is situated in the northeastern region of Bangladesh at 24.8949° North and 91.8687° East. Within the city corporation, the principal forms of public transport are cars, bikes, small trucks, motor vehicles, and vehicles (CNG). According to a Bangladesh Bureau of Statistics (BBS) study, Sylhet City Corporation's roadways were home to registered and unregistered paratransit modes in 2011 [7]. Non-motorized vehicles such as rickshaws (human-powered), bikes (battery-powered), and vans were the most frequent kinds of paratransit in Sylhet [8]. Moreover, motorized vehicles like the Laguna and Tempo were accessible throughout Sylhet [9]. Compared to other Bangladeshi cities, the population growth rate is strong enough, and it handles many travelers each calendar month. The noise level in Sylhet has enhanced remarkably throughout the past few

years. Due to the intensification in the density of inhabitants and tourists, the number of motorized (medium-sized and small) vehicles has significantly expanded, and commercial-industrial zones have also increased. As the road and traffic increase, the city becomes quite busy and loud [10]. The effects of clatter pollution are widely acknowledged worldwide. This investigation makes a minimal approach to recognizing the extent of pollution from noise and vehicle influence in the city of Sylhet.

Statement of the Problem

The research seeks to assess the amount of mindfulness among individuals who often experience unpleasant noise and the types of therapy they may have received from physicians due to noise exposure. The investigation is primarily qualitative. However, quantitative noise measurements are rigorously carried out better to understand the frequency of noise pollution in various places.

The subsequent goal was established to guide this research:

- To Determine the vehicular sound effects on noise pollution in the industrial and commercial zones of Sylhet City.
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Materials and Methods

According to "Environment Conservation Rules, 1997", BSCIC Industrial Estates-Khadim Nagar ($24°54'51.5''N - 91°56'24.8''E$), BSCIC Industrial Estates-Gutatikor ($24°52'28.8''N - 91°53'23.4''E$), Rajmohol Foods & Sweet Industry-Humayon Chottor ($24°52'37.7''N - 91°52'31.2''E$), Shahjalal Aluminium Factory-Zokigonj Road ($24°53'08.3''N - 91°52'53.9''E$) & Afrooz Polymer Industries-Uposhohor main Road ($24°53'09.1$ "$N - 91°52'53.3''E$) were considered as Industrial Zone.

According to "Environment Conservation Rules, 1997", Zindabazar Point, Sylhet ($24°54'22.3''N - 91°55'54.5''E$), Mejortila Point, Islampur Road, Sylhet ($24°53'41.7''N - 91°52'07.4''E$), Mohajon Potti, Sylhet ($24°53'23.8''N - 91°52'23.2''E$), Rikabibazar Point, Rikabibaazar Road, Sylhet ($24°53'55.6''N - 91°51'42.7''E$) and Modina Market point, Sunamgonj Highway, Sylhet ($24°54'36.9''N - 91°50'53.9''E$) were considered as Commercial Zone.

Standards for sound			
SI. NO.	**Classification of Zone/Area**	**Maximum value (dB)**	
		Daytime	**Nighttime**
A	Industrial Zone	75	70
B	Commercial Zone	70	60

Table 1. Standards for sound (SCHEDULE-4) (Forest, 1997)

"Environmental Conservation Rules-1997" state that the periods between 6 am and 9 pm are considered daytime, and the hours between 9 pm and 6 am are considered nighttime [11].

An industrial zone is a zone that specializes in both the creation of industrial goods and the supply of commercial services, has defined geographical limits, and is formed in line with government rules [12]. The term "commercial zone" refers to and comprises areas designated for shops, exhibition rooms, stores or godowns, warehouses, retail malls, hotels or restaurants, and filling stations, to name a few [13].

There are various sorts of tools for measuring noise levels. Examples include the Sound Level Meter and the Integrated Sound Level Meter, to name a few. This study uses the Sound Level Meter to measure vehicular sound. The Sound Level Meter comprises three basic components: microphones, electrical circuits, and a reader display. Moreover, microphones detect and convert sound fluctuations into electrical impulses, and then this electrical signal will be processed by electronic circuits within the device; after that, the outcome of the procedure on the electronic circuit will be displayed in the reader display as the result of measurement [14].

Flowchart of Methodology

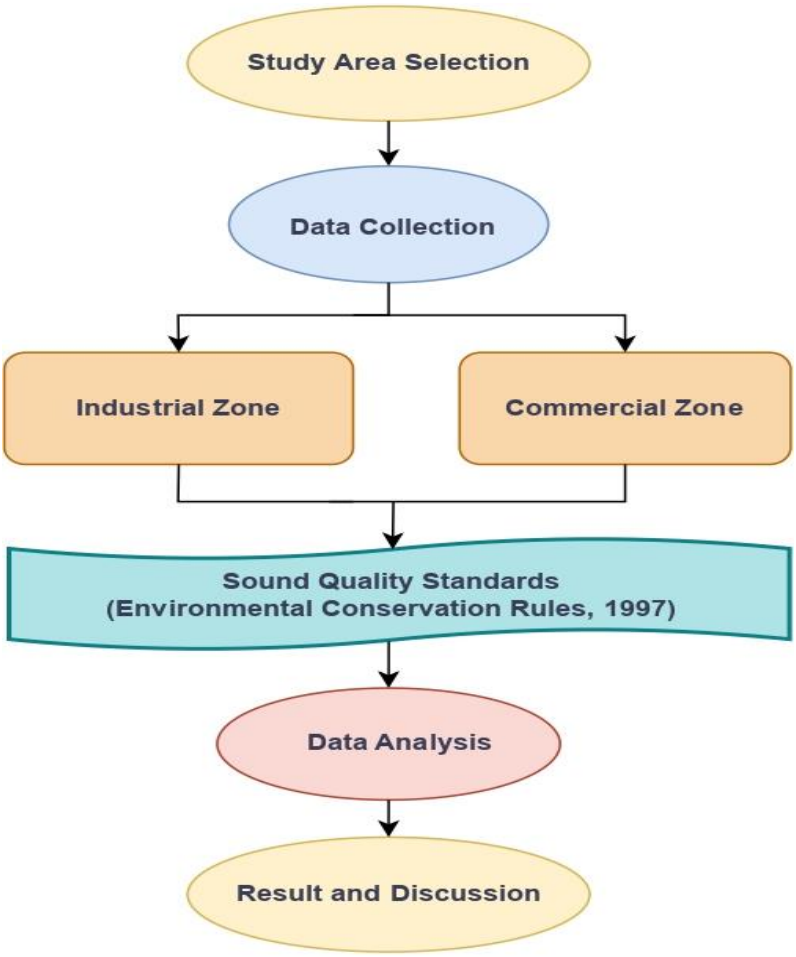

Figure 1. Methodology flowchart

Results

Figure 2 was set up to relate between standard values and observe data for the industrial zone. All points were below the standard sound level at 6:00 am. From 9:00 am to 12:00 am, the sound level was above the acceptable level of the industrial zone, excluding Rajmohol Foods & Sweet Industry-Humayon Chottor at 9:00 am (72.6 dB), and it was highest at 12:00 pm (91.3 dB) at BSCIC Industrial Estates- Khadim Nagar.

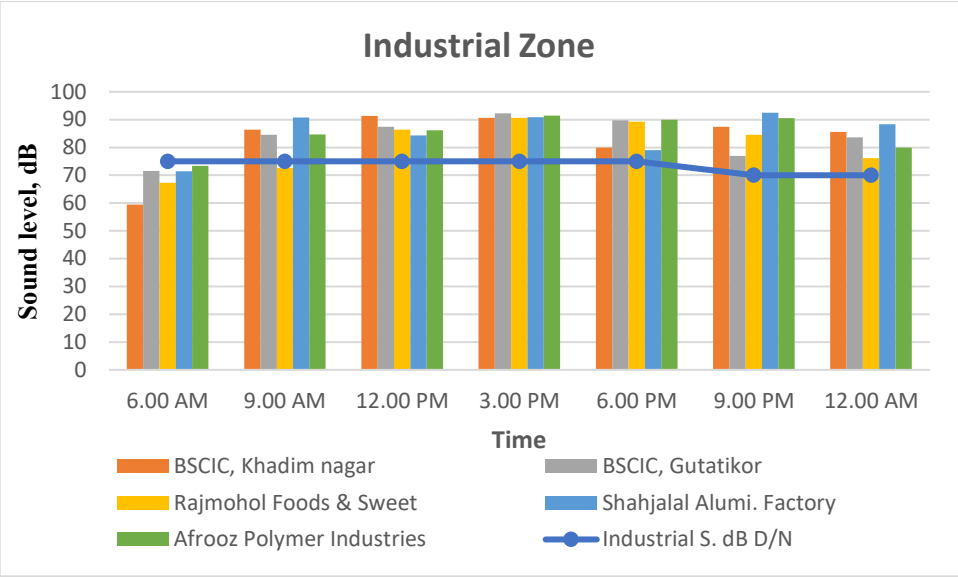

Figure 2. Comparison between Standard Value and Observe Data for Industrial Zone

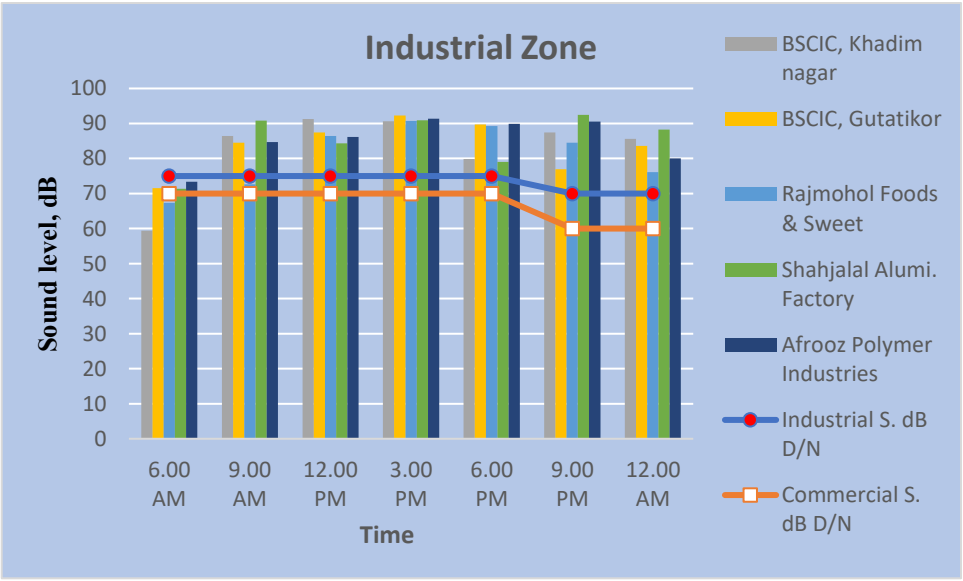

Figure 3. Relation between Industrial Zone with Commercial Zone Standard Decibel

In the chart (Figure 3), the standard decibels at day and nighttime of the Industrial Zone and Commercial Zone were viewed by line diagram where an upright column indicated the collected data from the Industrial Zone. However, every time, in all the points collected, data exceeded the standard sound level limits of the Industrial Zone by considering "Environmental Conservation Rules-1997". Nevertheless, at 6:00 am, data was exposed to a limited level, and the commercial zone standard sound level limit was satisfied.

In this graph (Figure 4), PCU values were on the right side, and Sound Level values were on the left. The busiest point (Afrooz Polymer Industries) was considered when analyzing the vehicular effect. The sound level at Afrooz Polymer Industries was 73.4 dB, and the PCU value was 74.4 at 6:00 am. From Figure 4, it is observed that the sound level increased and decreased with the PCU value. For PCU value 1290.9, the sound level was maximum (91.4 dB) at 3:00 pm. To keep the area silent according to the Industrial Zone reference level, preserving a PCU value of around 75 is required.

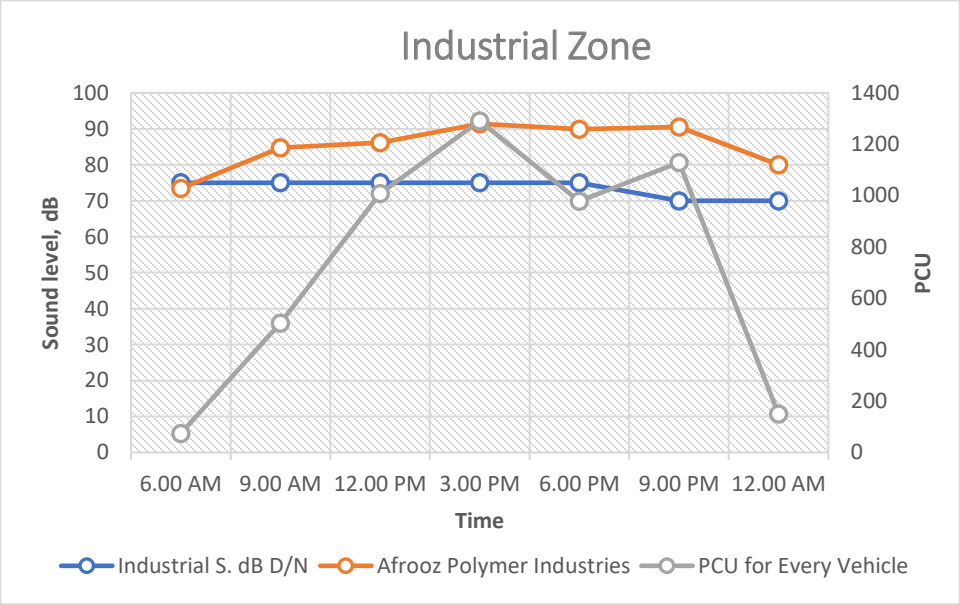

Figure 4. Passenger Car Unit (PCU), Sound Level at Afrooz Polymer Industries in Industrial Zone

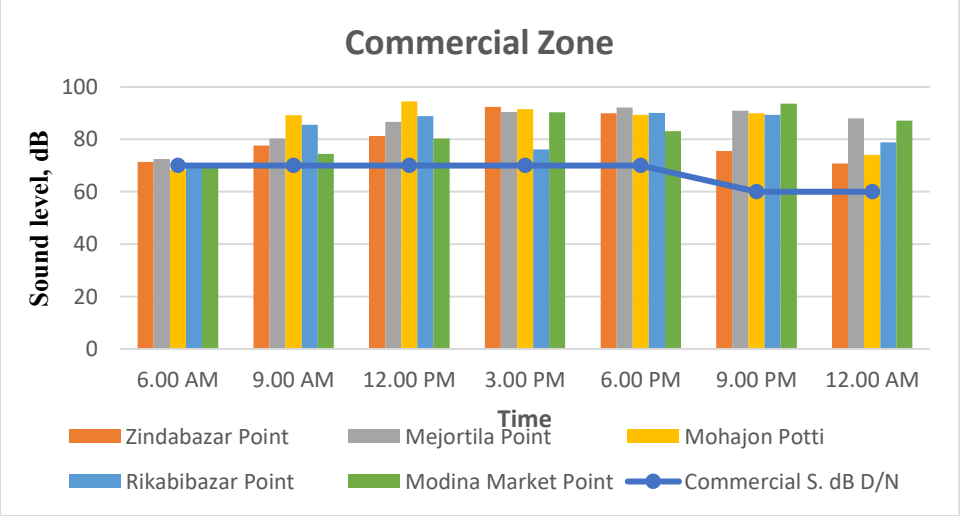

Figure 5. Comparison between Standard Value and Observe Data for Commercial Zone

Figure 5 was established to compare standard values and observe data for the Commercial Zone. From 9:00 am to 12:00 am, the sound level was above the allowable level of the commercial zone except at 6:00 am. It was highest at 12:00 pm (94.5 dB) in Mohajon Potti and minimum at 12:00 am (70.8 dB) in Zindabazar Point.

In the chart (Figure 6), the standard decibels at day and nighttime of the Industrial Zone and Commercial Zone were presented by line diagram, where the vertical column indicated the collected data from the Commercial Zone. From 9:00 am to 12:00 am, collected data was above the standard sound level limits of the Commercial Zone according to "Environmental Conservation Rules-1997," not even satisfy the Industrial Zone standard limit. Only the 6:00 am collected data matches the Commercial Zone noise limit and satisfies the Industrial Zone standard decibel level.

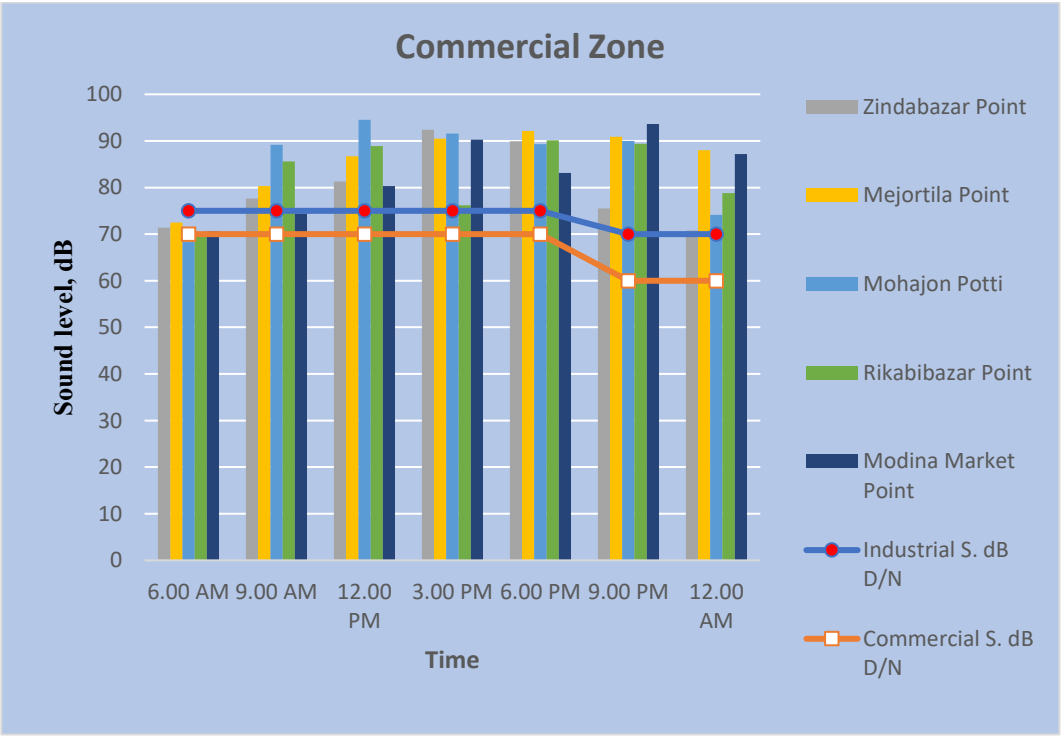

Figure 6. Relation between Commercial Zone with Industrial Zone Standard Decibel

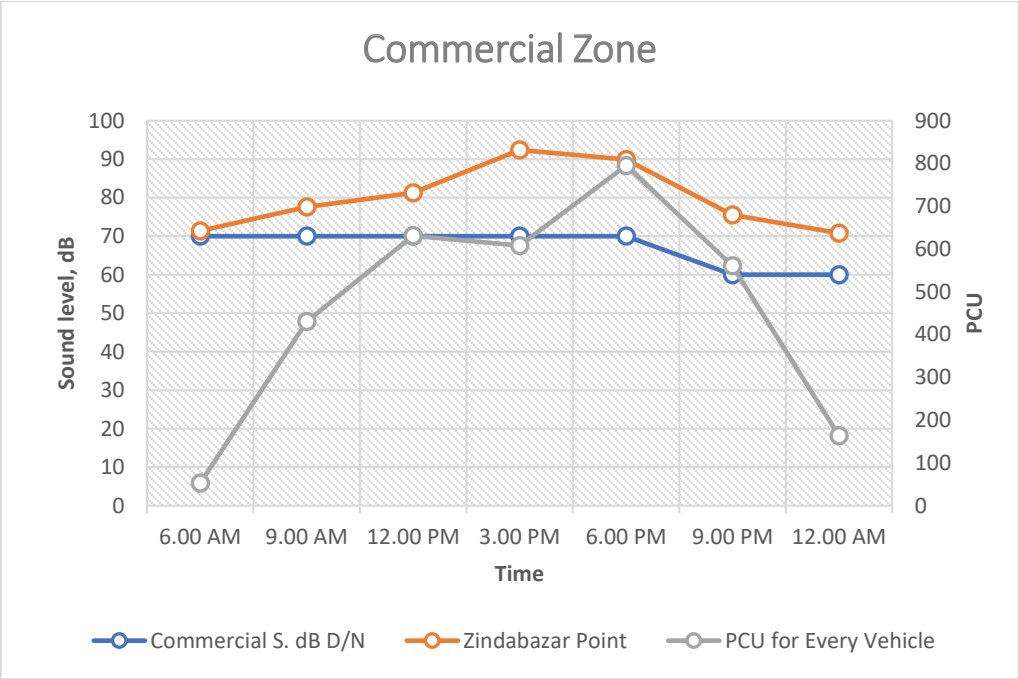

Figure 7. Passenger Car Unit (PCU), Sound Level at Zindabazar Point in Commercial Zone

In this graph (Figure 7), values of PCU were contained on the right side, and values of Sound Level on the left side. The Zindabazar Point was the busiest area compared with the study areas (Commercial Zone). PCU value was 52.5 at 6:00 am, and the sound level was 71.4 dB. It is seen that the sound level increased with the PCU value. For PCU value 795.3, the sound level was (89.9 dB) at 6:00 pm. It is necessary to maintain a PCU value of less than 52To keep the area silent according to the Commercial Zone recommendation level.

Discussion

Industrial and commercial zones in Sylhet City are highly vulnerable to noise abuse, where transportation contributes to noise pollution. The level of noise present in the industrial and commercial areas of the city was inspected in the research. For the Industrial zone, the Standard Decibel during the day is 75 dB, and at night is 70 dB. However, the collected maximum sound level was 92.5 dB, and the minimum sound level was 67.3 dB. Considering the Commercial zone, the Standard Decibel during the day is 70 dB, and at night is 60 dB. Nevertheless, considering the data gathered during the day and nighttime, the highest sound level was 94.5 dB, and the minimum sound level was 70.3 dB. In every case, the sound level was not up to the stage as per "Environmental Conservation Rules-1997," the key impacting factor was vehicular noise.

Conclusions

The study has highlighted how noise from traffic substantially influences the neighborhood and its inhabitants. The study emphasized the critical need for effective mitigation techniques to reduce noise contamination and its harmful outcomes on the health and well-being of the public. The findings highlight the complex link between urbanization, automobile density, and rising levels of noise pollution. As industrial and commercial activity expands, traffic noise pollution becomes more complex. This study has proven the importance of implementing comprehensive and targeted steps to solve this issue, requiring coordination among municipal governments, urban planners, transportation agencies, and environmental specialists. Furthermore, the study underlines the necessity of boosting public knowledge about the detrimental effects of excessive loud pollution. Community participation (in implementing some rules and fines) and instruction can be critical in encouraging ethical driving and establishing a noise-reduction culture. Promoting quieter technology and encouraging environmentally friendly transportation choices might also help reduce long-term noise pollution. While this study sheds insight into the issues caused by automotive noise pollution, it also opens the door for further research. Additional research might focus on novel noise-reduction technology, sustainable urban design practices, and legislative interventions to provide the people of Sylhet City with calmer and better living circumstances.

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