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Assessment of Traffic-Induced Noise Pollution in Dhaka City: A Case Study of Twenty Urban Locations

Abhijit Nath Abhi[a,*], Rashedul Islam[b], Md. Mosfiqur Rahman Rafid[c], Nafi Md. Abrar Kabir[c]

[a]Department of Civil Engineering, Dhaka International University, Satarkul, Badda, Dhaka-1212, Bangladesh

[b]Bangladesh Water Development Board, 72 Green Road, Dhaka-1205, Bangladesh

[c]Department of Civil Engineering, Ahsanullah University of Science and Technology,141-142 Love Road, Dhaka-1208, Bangladesh

***Corresponding Author:** Abhijit Nath Abhi (abhijitnath.ce@gmail.com)

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Abstract

This study examines the extent of noise pollution resulting from vehicular traffic across twenty strategically selected commercial and residential locations within Dhaka, Bangladesh. Data collection was conducted during afternoon peak hours (5:00 PM and 8:00 PM) using mobile-based sound meter applications in conjunction with manual classified traffic volume counts. The analysis indicates that noise levels at the majority of surveyed sites exceeded the permissible thresholds established by the World Health Organization. Notably, commercial zones exhibited particularly high average noise levels, reaching up to 76 dB(A), with Technical Mor and Mirpur-10 among the most affected areas. Although residential zones recorded comparatively lower levels, they too surpassed recommended noise standards. A strong positive correlation was identified between traffic volume and elevated sound pressure levels (SPL), emphasizing the critical need for effective urban noise mitigation measures. This paper underscores the importance of implementing updated traffic management policies, enhancing urban green infrastructure, regulating the use of vehicle horns, and fostering public awareness to address the escalating issue of traffic-induced noise pollution in Dhaka.

Keywords: Noise Pollution, Traffic Volume, Dhaka City, Sound Pressure Level (SPL), Urban Environment

Introduction

Noise pollution refers to consistent exposure to elevated sound levels that may negatively affect human health and the well-being of other living organisms [1]. According to the World Health Organization (WHO), exposure to sound levels below 70 decibels (dB) is generally not harmful, regardless of duration [2]. However, continuous exposure to sound levels exceeding 85 dB for more than eight hours a day can pose serious health risks. Individuals working near high-traffic areas such as busy roads or highways are particularly vulnerable, as they may be exposed to ambient noise levels approaching this threshold on a daily basis [3].

In Bangladesh, particularly in Dhaka city, noise pollution has become a pressing urban issue. According to the Department of Environment (DoE), average noise levels in several city zones regularly exceed 80 dB(A), especially in commercial intersections like Farmgate, Mirpur, and Mohakhali. A 2023 report revealed that 94% of areas in Dhaka experience noise levels beyond the safe limits [4]. Traffic noise is among the primary contributors to urban noise pollution. Highways, in particular, generate considerable noise, especially during periods of heavy traffic at elevated speeds and jam density [5]. The main sources of this noise include engines, exhaust systems, and tire-road interactions from a wide variety of vehicles just like cars, buses, trucks, and motorcycles [6]. The intensity of traffic noise is closely linked to traffic volume, which itself is influenced by urban growth, industrial activity, and population density [7]. Consequently, as cities expand, noise from traffic becomes increasingly pervasive [8].

Prolonged exposure to high-intensity noise can result in both temporary and permanent hearing impairment. The physiological mechanisms underlying noise-induced hearing loss are well documented [9] and the degree of risk varies based on individual sensitivity and the nature of the exposure [10]. When average sound levels remain below 75 dB for an eight-hour period, the risk is generally considered minimal. However, exposure above this threshold significantly increases the likelihood of auditory damage, known in the literature as “damage risk” [11].

Exposure to environmental noise can trigger immediate physiological stress responses, such as increased heart rate and elevated blood pressure [12]. Over extended periods, these responses may become chronic, contributing to long-term cardiovascular issues. Research has also shown that sustained exposure to high noise levels may negatively affect the respiratory and motor coordination systems [13]. Comparative studies involving populations living in high-noise urban environments versus quieter residential areas have demonstrated measurable differences in blood pressure, sleep quality, and general well-being [14]. These findings underscore the importance of recognizing noise as not only an environmental nuisance but also a significant public health concern.

Traffic noise, beyond its cardiovascular and auditory effects, disrupts sleep quality, especially at night when levels exceed 40 dB(A). Prolonged exposure above 55 dB(A) increases hypertension risk, while children are particularly vulnerable to cognitive impacts [15]. Traffic noise, particularly from aircraft, roads, and railways, has a significant psychological impact, with annoyance levels increasing alongside noise intensity. Non-acoustic factors such as individual sensitivity and public perception further exacerbate this effect [16]. These findings support the need for updated noise guidelines to mitigate growing public health concerns and also the need for policies addressing chronic, low-level urban noise exposure.

In the 21st century, environmental noise has become a widespread and largely inescapable concern. Whether at home, on the street, in public transportation, or in recreational spaces, noise is a constant element of daily life [17]. Common

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sounds such as loud music, traffic, phone conversations, and barking dogs have become so embedded in urban culture that they often go unnoticed. However, when these everyday sounds exceed acceptable levels, they shift from being benign background noise to harmful environmental pollutants [18].

Despite ongoing regulatory efforts, noise pollution persists as a significant global issue. Much like second-hand smoke, “second-hand noise” is an involuntary exposure that can affect individuals without their consent and in situations where control over its source, timing, or intensity is limited [19]. This involuntary exposure is particularly troubling given growing evidence that noise pollution has far-reaching health, social, and economic consequences [20].

As urbanization intensifies and sources of anthropogenic noise become more prevalent and powerful, population-wide exposure to noise continues to rise. Studies have shown that even noise levels below the threshold for auditory damage can activate subconscious stress responses in the brain [21]. These responses, triggered even during sleep, initiate the body’s autonomic “fight or flight” mechanism, leading to hormonal imbalances, vascular stress, and long-term cardiovascular effects [22]. As such, environmental noise should be regarded not only as a quality-of-life issue but also as a critical public health challenge.

This study aims to explore how traffic contributes to noise pollution in Dhaka by focusing on three key objectives:

1. To measure the levels of noise pollution caused by road traffic at selected urban locations.
2. To record and analyze the flow of vehicles in these areas during peak hours.
3. To examine the link between traffic volume and noise levels, helping to better understand how increased vehicle activity affects the surrounding sound environment.

Study Area

Dhaka, the capital of Bangladesh, is situated in the central part of the country at approximately 23°42′N latitude and 90°22′E longitude. Positioned along the eastern banks of the Buriganga River, the city spans an area of about 306.38 square kilometers (118.29 square miles) and lies within the lower reaches of the Ganges Delta. For this study, noise levels and traffic volumes were monitored at twenty strategically selected locations across Dhaka, including both major roads and connecting link roads of ten that reflect the city’s diverse traffic conditions and also ten residential areas based on how varied the land use is in each area, helping to reflect the diverse conditions people experience every day in different parts of the city. The exact locations of the survey points were mapped using GPS, with both latitude and longitude recorded for consistency and repeatability in future studies that is shown in Table 1.

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Table 1. Location of Study Area

Location	Latitude (˚N)	Longitude (˚E)
Mirpur-1	23.80192	90.35235
Mirpur-2	23.80504	90.35853
Mirpur-10	23.80041	90.37146
Zoo Road	23.80674	90.35153
Technical Mor	23.78149	90.35215
Kallyanpur	23.777829	90.361507
Shyamoli	23.77760	90.36019
Asadgate	23.76013	90.37280
Farmgate	23.75815	90.38965
Shishumela	23.77341	90.36541
Saha Ali Bag	23.79747	90.35636
Ahmednagar	23.79363	90.36008
Paikpara	23.78604	90.36183
Rupnagar	23.81523	90.35475
Senpara	23.80503	90.35853
Pallabi	23.82500	90.35800
Mirpur DOHS	23.82235	90.36542
Modina nagar	23.78300	90.36000
Geneva camp	23.74600	90.36700
Lalkuthi	23.75000	90.37000

Method of Sound Level Measurement

To assess noise levels in twenty urban areas, this study used the CEL-231 Sound Level Meter, a reliable, general-purpose instrument suitable for environmental noise monitoring which is shown in Figure 1. Before each measurement session, the meter was calibrated using a standard acoustic calibrator set at 94 dB and 1 kHz to ensure the accuracy of the readings. The meter was set to A-weighting, which reflects how the human ear perceives sound, and the response time was set to 'Slow' to smooth out short-term fluctuations in noise. All measurements were taken in Leq (Equivalent Continuous Sound Level) mode, which calculates the average noise level over time and is useful for capturing the overall sound environment in a given area.

Measurements were taken at twenty locations across the city, including residential zones and commercial zones. At each site, the meter was placed at about 1.5 meters above the ground, roughly at ear level to better reflect the typical human experience of sound. The meter was either handheld or mounted on a tripod, depending on the situation, and care was taken to keep it away from reflective surfaces like walls or metal structures. When measuring outdoors, a windscreen was used over the microphone to reduce the impact of wind on the data. Depending on the setup, readings were either noted manually. After each session, the device was recalibrated to confirm that the measurements remained consistent and accurate.

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In parallel with noise data collection, traffic volumes were manually counted. Vehicles were categorized by type to explore how different traffic compositions might affect ambient noise levels. This combination of noise and traffic data provides a clearer picture of how urban mobility contributes to environmental soundscapes in Dhaka.

Figure 1. Sound measured meter (Model-CEL-231)

Result and Discussion

Traffic Flow

In this study, traffic data was collected from twenty key locations in Dhaka, categorized into commercial and residential zones, to better understand the variation in traffic composition and overall flow patterns. Table 2 shows the traffic flow at different selected locations at Dhaka city.

The commercial areas surveyed places like Technical Mor, Asad Gate, Kallyanpur, and Shamoli were buzzing with traffic. These spots saw some of the heaviest vehicle flows, with totals ranging from around 1,140 to 1,700. Asad Gate topped the list with the highest volume at 1,700 vehicles, followed closely by Technical Mor with 1,650, and Kallyanpur with 1,558. In all these areas, private cars and motorcycles were by far the most common sights, often numbering over 500 at each location. At Technical Mor, for example, there were 540 cars and 660 bikes weaving through the intersection. Asad Gate, a particularly busy junction, recorded the highest numbers of 600 cars and 720 motorcycles. It’s clear that this area handles a dense flow of everyday traffic. CNG auto-rickshaws and buses were also a regular part of the mix, adding to the already high volumes. Emergency vehicles like ambulances were present too, though in much smaller numbers typically fewer than 30 in each location.

Compared to the bustling commercial zones, residential areas like Saha Ali Bag, Ahmednagar, Paikpara, and Rupnagar experienced lighter traffic, with vehicle counts generally ranging from around 950 to just under 1,200. Still, for residential neighborhoods, the traffic was surprisingly varied and fairly dense. Senpara stood out with the highest volume among these areas, clocking in at 1,189 vehicles. A large portion of that came from private cars (590) and motorcycles (360). Mirpur DOHS and Modinanagar weren't far behind, each seeing over 1,100 vehicles. While buses weren't as common here as in the commercial zones, they still made a noticeable appearance typically between 70 and 95 in most neighborhoods. Cars and bikes continued to dominate the roads, with a fair number of CNG auto-rickshaws also in the mix. As expected, emergency vehicles like ambulances were few and far between, with most locations seeing just 3 to 5.

Table 2. Traffic flow at twenty locations

Zone	Location	CNG	Bus	Car	Bike	Ambulance	other	Traffic flow
Commercial Zone	Mirpur-1	90	130	420	440	12	48	1140
	Mirpur-2	84	136	435	420	18	60	1153
	Mirpur-10	120	150	480	460	18	48	1276
	Zoo Road	95	140	437	425	12	48	1157
	Technical Mor	110	190	540	660	30	120	1650
	Kallyanpur	95	140	533	680	30	80	1558
	Shyamoli	80	160	480	590	30	80	1420
	Asadgate	110	160	600	720	30	80	1700
	Farmgate	140	160	540	620	12	40	1512
	Shishumela	110	130	460	640	18	40	1398
Residential Zone	Saha Ali Bag	70	90	475	321	3	48	1007
	Ahmednagar	90	72	460	350	3	36	1011
	Paikpara	86	70	440	320	5	50	971
	Rupnagar	70	75	420	340	2	50	957
	Senpara	95	95	590	360	4	45	1189
	Pallabi	76	80	530	378	4	40	1108
	Mirpur DOHS	90	80	575	355	5	47	1152
	Modina nagar	92	87	534	357	2	45	1117
	Geneva camp	95	75	430	340	4	48	992
	Lalkuthi	94	75	510	345	4	60	1088

Commercial areas clearly faced heavier and more varied traffic, with a noticeable presence of buses and other commercial vehicles. This higher volume naturally ties in with greater noise levels and more congestion. On the other hand, residential neighborhoods had lighter traffic overall, but cars and motorcycles still dominated the roads. This points to consistent local movement and daily commuting, even if the flow wasn't as intense. Understanding these patterns is key when looking at noise pollution. The type of traffic especially the presence of louder vehicles like buses and motorcycles has a big impact on the soundscape of a city. By breaking traffic down this way, we get a clearer picture of where and why noise levels rise in different parts of the urban environment.

Noise Pollution at Commercial Zone

Table 3 shows the maximum, minimum and average sound pressure level at ten locations of commercial zone and Figure 2 shows the average sound pressure level by comparing with the standard value.

Table 3. Maximum, minimum and average sound pressure level at ten locations of commercial zone

Serial	Location	Sound pressure levels, dB(A)		
		Minimum	Maximum	Average
1.	Mirpur-1	58.5	81.9	70.2
2.	Mirpur-2	50.9	79.5	65.2
3.	Mirpur-10	57.3	84.3	70.8
4.	Zoo Road	52.5	84.80	68.65
5.	Technical Mor	67.5	84.50	76.00
6.	Kallyanpur	57.4	78.80	68.1
7.	Shyamoli	57.3	81.60	69.45
8.	Asadgate	54.2	79.40	66.80
9.	Farmgate	49.80	76.20	63.00
10.	Shishumela	47.60	76.50	62.05

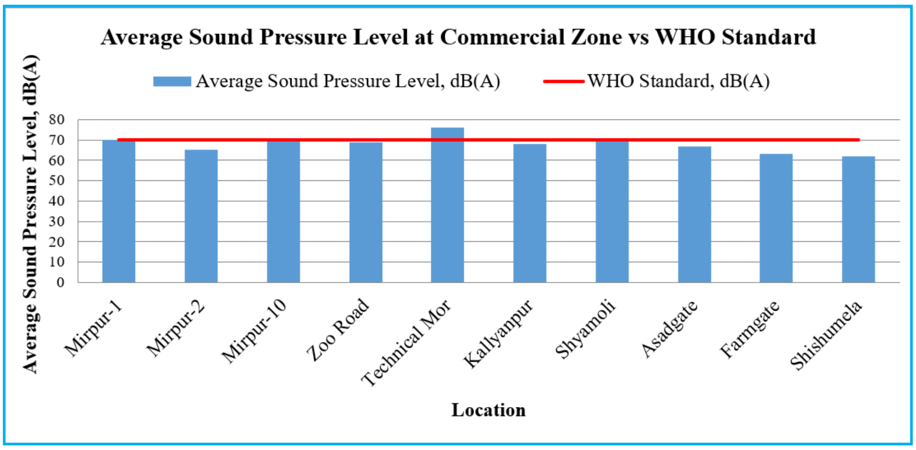

Figure 2. Average sound pressure level at selected locations of commercial zone

To get a clearer picture of traffic-related noise pollution, sound levels were measured at ten busy commercial spots across Dhaka city. Using standard procedures, recorded the minimum, maximum, and average sound pressure levels was recorded in decibels dB(A).

Among all the locations, Technical Mor stood out with the highest average noise level of 76.00 dB(A). That's well above the World Health Organization's recommended limit of 70 dB(A) for commercial areas. Even the lowest recorded level there was 67.5 dB, while the highest hit 84.5 dB, suggesting constant exposure to loud, potentially harmful noise. Mirpur-10 and Mirpur-1 weren't far behind, with average noise levels of 70.8 and 70.2 dB(A), respectively also above the WHO threshold. These readings point to steady, elevated noise in these areas that could have real consequences for public health. Other locations, like

Shamoli (69.45 dB), Zoo Road (68.65 dB), and Kallyanpur (68.1 dB), stayed just under the 70 dB mark. Still, these levels are high enough to cause discomfort or health concerns if people are exposed for long periods. Even in somewhat quieter spots like Farmgate (63.0 dB) and Shisumela (62.05 dB), the noise levels were still above what's considered safe for residential zones highlighting how loud even moderate commercial traffic can be.

All in all, these results confirm that many of Dhaka's commercial areas consistently experience noise levels that surpass health-based guidelines, underlining the urgent need for smarter noise control and urban planning.

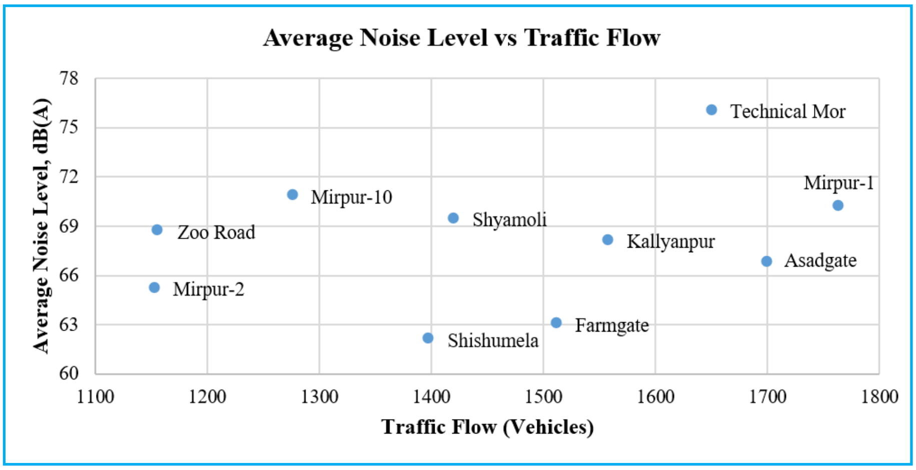

Figure 3. Relationship between average noise level and traffic flow at commercial areas

Figure 3 shows how average noise levels vary with traffic flow across different commercial areas in Dhaka city. While it might seem intuitive to expect noise levels to rise steadily with an increase in the number of vehicles, the plot tells a more complex story. In some locations, high traffic flow does lead to higher noise levels, but this isn't always the case. There are areas with a large number of vehicles on the road that still experience comparatively moderate noise levels. On the other hand, some places with less traffic are surprisingly noisy. This suggests that traffic volume alone doesn't determine how loud an area becomes. Other elements such as the types of vehicles on the road, how often drivers honk, road surface quality, intersections, and surrounding buildings are likely play a big role in shaping the noise environment.

Noise Pollution at Residential Zone

Table 4 shows the maximum, minimum and average sound pressure level at ten locations of residential zone and Figure 4 shows the average sound pressure level by comparing with the standard value.

To better understand noise levels in Dhaka's residential neighborhoods, sound pressure measurements were taken at ten different locations during 5.00 PM to 8.00 PM. These readings captured the minimum, maximum, and average noise levels in decibels [dB(A)]. On the whole, most residential areas stayed below the World Health Organization's recommended limit of 55 dB(A) for living spaces but

Table 4. Maximum, minimum and average sound pressure level at ten locations of residential zone

Serial	Location	Sound pressure levels, dB(A)		
		Minimum	Maximum	Average
1.	Saha Ali Bag	43.7	59.40	51.55
2.	Ahmednagar	45.2	58.30	51.75
3.	Paikpara	41.2	61.10	51.15
4.	Rupnagar	39.2	58.30	48.75
5.	Senpara	46.00	63.10	54.55
6.	Pallabi	42.7	61.10	51.90
7.	Mirpur DOHS	47.20	59.2	53.20
8.	Modinanagar	51.40	64.2	57.80
9.	Geneva Camp	42.50	63.8	53.15
10.	Lalkuthi	41.90	59.9	50.9

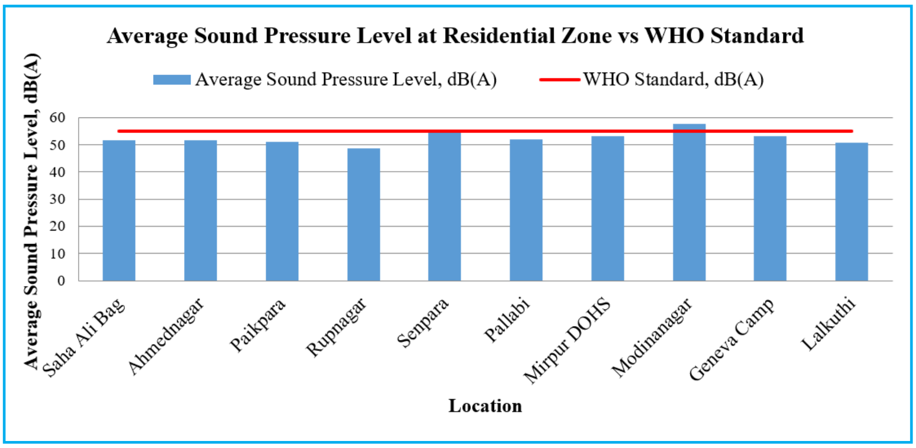

Figure 4. Average sound pressure level at selected locations of residential zone

there were a few exceptions. Modinanagar recorded the highest average noise level at 57.80 dB(A), crossing the safe threshold and hinting at a potentially disruptive environment for those who live there. Some other neighborhoods, like Senpara (54.55 dB) and Mirpur DOHS (53.20 dB), came close to the guideline. While these levels might not seem alarming at first glance, prolonged exposure could still lead to sleep disturbances, increased stress, or other health issues especially for children, the elderly, or people with existing health conditions.

On the quieter end, Rupnagar (48.75 dB), Lalkuthi (50.9 dB), and Paikpara (51.15 dB) stood out as the most peaceful areas, likely due to lower traffic and less urban activity. Overall, the data shows that while many of Dhaka's residential zones maintain relatively safe noise levels, some areas are nearing or surpassing what's considered healthy. This highlights the need for targeted strategies like creating green spaces, slowing down traffic, and raising awareness to help keep these neighborhoods livable and protect residents' well-being.

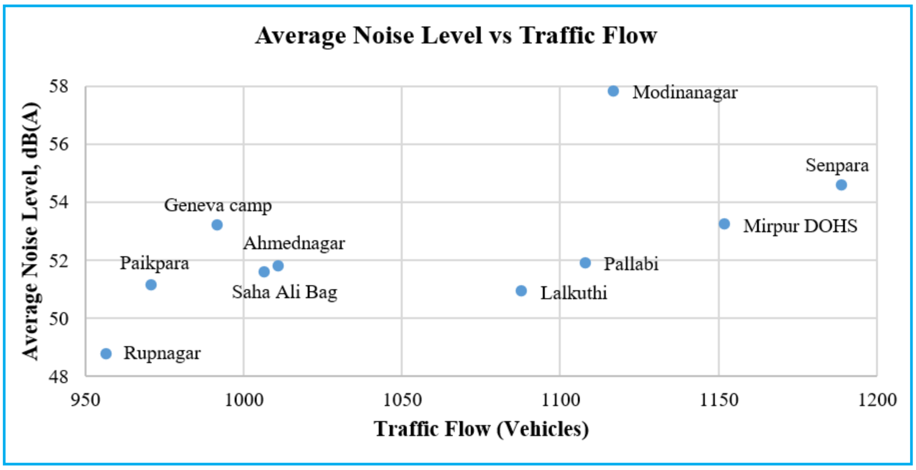

Figure 5. Relationship between average noise level and traffic flow at residential areas

When comparing the Figure 3 and 5, a clear difference emerges in how traffic flow affects noise levels across various urban locations. The Figure 3 includes major traffic zones such as Mirpur-1 and Technical Mor, where both vehicle flow and noise levels are relatively high. Noise levels in these areas range from about 62 to 76 dB(A). In these areas, the data shows a consistent pattern: as traffic increases, so does the average noise level. This suggests a strong connection between traffic volume and urban noise in busier parts of the city. In contrast, the Figure 5 represents less congested areas like Rupnagar and Modinagar. Here, both traffic and noise levels are noticeably lower mostly between 48 and 57 dB(A). This variation points to other possible influences, such as building density, green space, or local road conditions, which may help block or absorb sound.

Taken together, the Figure 3 and 5 highlight how noise exposure varies across city zones. Heavily trafficked areas tend to experience higher noise pollution, while quieter residential areas show lower levels. However, traffic alone doesn't explain everything but also the physical and environmental characteristics of each location play a key role. Understanding these differences is essential for developing effective, location-specific noise control strategies in urban planning.

Recommendations

1. Our planet is becoming increasingly polluted by a wide range of harmful substances. As global citizens, it's our shared responsibility to protect the environment. While governments are taking steps by introducing new laws and regulations, real change also depends on how we respond. Each of us must do our part by following these rules and staying mindful of how our actions affect the world around us. If we don't take this seriously, the damage will ultimately come back to affect our own health and well-being.

2. In public areas, we should be careful not to overuse loudspeakers and ensure they don't exceed the permissible noise limits and the hydraulic horn should be banned.

3. Vehicle horns should be used responsibly and avoided entirely in sensitive areas like hospitals, schools, and other healthcare or educational institutions, where silence is often necessary.
4. Planting trees along roadways to act as natural sound barriers.
5. More research is needed to better understand what works best in reducing noise pollution in cities and how we can put those solutions into action in real-life settings.
6. Future research could include morning peak hour measurements to enable a comparative analysis between morning and evening noise levels.

Conclusion

This study set out to assess the impact of traffic-related noise pollution in Dhaka city. The results clearly show that noise levels in many areas are alarmingly high, often causing discomfort and potentially leading to health issues for residents. Findings revealed that several commercial areas, such as Technical Mor (76.0 dB), Mirpur-10 (70.8 dB) and Mirpur-1 (70.2 dB), consistently surpassed WHO's recommended noise limits. Even residential zones like Modinanagar recorded average levels of 57.8 dB(A), indicating widespread exposure. These findings highlight the urgent need for national noise control standards to help manage and reduce environmental noise. A focused study of examining hearing loss and health survey is warranted. In addition to stricter regulations, several practical steps could help reduce current noise levels. These include planting trees along roadways to act as natural sound barriers, banning the use of hydraulic horns, improving road and parking infrastructure, relocating noisy industries away from residential areas, and promoting public awareness about the effects of noise pollution. Together, these efforts can make Dhaka a quieter and healthier place to live.

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Conflicts of Interest

The authors declare no competing interest.

Author Contributions

Abhijit Nath Abhi: project administration, supervision, writing - original draft, investigation, visualization. **Rashedul Islam:** data curation, formal analysis. **Md. Mosfiqur Rahman Rafid:** methodology, conceptualization. **Nafi Md. Abrar Kabir:** writing - review & editing.

Data Availability Statement

The data used to support the findings of this study are included within the article.

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