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ASSESSING THE LEVELS OF NOISE POLLUTION IN GAIBANDHA DISTRICT TOWN OF BANGLADESH

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Abstract:
The objective of this study was to assess the extent of noise pollution in several localities within Gaibandha District Town. In Gaibandha District Town, 40 locations and 7 distinct zones were selected according to land utilization. We employed a sound level meter (REED SD-4023) to assess the noise levels in Gaibandha District Town. A multitude of samples were collected at each sampling location. Three times a day, each location's noise level was measured. The Leq was determined to be 89.31 dBA, and the mean noise level was 71.33 dBA. The mean noise level ranking for Gaibandha District Town was Road Intersection (78.20 dBA) > Commercial Area (74.55 dBA) > Mixed Areas (73.13 dBA) > Residential Area (72.30 dBA) > Silent Area (70.82 dBA) > Village Area (66.12 dBA) > Industrial Area (64.17 dBA). Mohori Para (80.80 dBA) had the highest mean noise level, while Media Agro Marketing and Industry (57.91 dBA) had the lowest mean noise level. In every location examined in our study, the noise levels exceeded the national standard.

Keywords: Noise Pollution, Land Use, Noise Standard, Dispersion, Cluster, Gaibandha District Town, Bangladesh.

INTRODUCTION

Noise pollution occurs when there is an excess of loud or disruptive sounds in the environment. These sounds can disrupt regular activities, adversely affect the health of humans and animals, and perhaps lead to long-term health issues. The noise pollution in Gaibandha City is escalating due to rapid population expansion and a rising number of inhabitants. Primary contributors to noise pollution encompass loudspeakers utilized at public events, construction activities, industrial operations, and high vehicular traffic. The incessant honking of vehicles, construction activities, and cacophony from marketplaces and enterprises render the neighborhood increasingly uncomfortable. Constant exposure to noise detrimentally affects individuals' quality of life and can lead to many health issues, including headaches, fatigue, stress, hearing impairment, diminished work performance, and sleep disturbances.

Likewise, prolonged exposure to a noisy urban environment can significantly impair the cognitive functions and auditory health of its inhabitants, particularly children. When students experience stress, they are more inclined to engage in detrimental behaviors, such as procrastination, smoking, excessive drinking, and substance abuse. Motorized vehicles constitute the primary source of noise pollution in urban areas. Excessive noise negatively impacts the environmental conditions and socioeconomic status of our country. Without restrictions, biodiversity will decline, and human lifestyles will become unsustainable over time.

Traffic police officers are significantly more susceptible to illness due to noise and air pollution, particularly at congested junctions. They frequently have auditory impairments and psychological challenges. Notwithstanding the government's initiatives to mitigate noise pollution in the bustling metropolis, it continues to be a considerable issue. Coughing is a significant issue for the upper

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respiratory tract; hence, many traffic police personnel use masks to shield themselves from the detrimental effects of air pollution. The majority of individuals are unaware of the impact of noise on their hearing, resulting in a protracted process that requires time to yield observable outcomes. The World Health Organization (WHO) identified 25 risk factors contributing to the worldwide disease burden attributable to occupational noise.

Occupational hearing loss, whether whole or partial, may affect one or both ears owing to numerous employment causes. It encompasses both traumatic hearing loss and noise- induced hearing loss (NIHL). Elevated noise levels in the workplace remain a global issue. For instance, more than 30 million individuals in the United States are employed in environments with hazardous noise levels. The World Health Organization (WHO) reported that detrimental noise levels impacted around 12% to 15% of the German workforce, equating to 4 to 5 million individuals.

Nearly all occupations include exposure to noise, but certain tasks—such as piloting commercial aircraft, managing specialty materials, and conducting impact operations—are linked to exceptionally high noise levels. Industries such as manufacturing, transportation, mining, construction, agriculture, and the military are among those most prone to causing noise-induced hearing loss (NIHL). The situation is improving in industrialized nations as an increasing number of individuals recognize the dangers and are implementing measures to mitigate them. Studies indicate that mean noise levels significantly exceed the recommended occupational threshold in several industrialized nations, despite little data for developing countries.

Noise can adversely affect your health through both auditory and non-auditory mechanisms. Researchers have investigated the impact of intense, high-frequency noise on several populations residing in afflicted regions. No research has been conducted in India about the impact of vehicle noise on the hearing of traffic police. The traffic police in Gaibandha District Town have the same difficulties with noise exposure. A likely cause is that these workers were not provided with hearing protection equipment. Traffic officers should focus solely on understanding the immediate health dangers. The majority of individuals do not perceive noise as a significant environmental concern, resulting in limited apprehension around its impacts. Medical professionals indicate that exposure to noises of 80 dBA or above for over 15 minutes may result in temporary or permanent hearing damage.

Currently, noise pollution in our nation may seem to be a minor concern. Nonetheless, it is prudent to contemplate the alternatives. If the government neglects the public good, noise issues may rapidly worsen in quality. This study examined noise pollution levels in several areas in Gaibandha District Town to assess the severity of the issue, analyze the correlation between noise levels and different land uses, and evaluate the distribution of noise levels throughout the city.

METHODS

Study Area. This research focuses on Gaibandha City (Figure 1). Gaibandha has recently experienced significant expansion in automobile and industrial numbers, along with robust visitor demand and growing urbanization, which contributed to its selection as the location. The ambient noise levels in Gaibandha City typically surpass international standards by two to three times. This phenomenon is linked to potentially detrimental impacts on human and environmental health. This research concentrated on the urban regions of Gaibandha, exhibiting higher traffic levels relative to others. 7 distinct zones and 40 locations were identified in Gaibandha City based on land usage.

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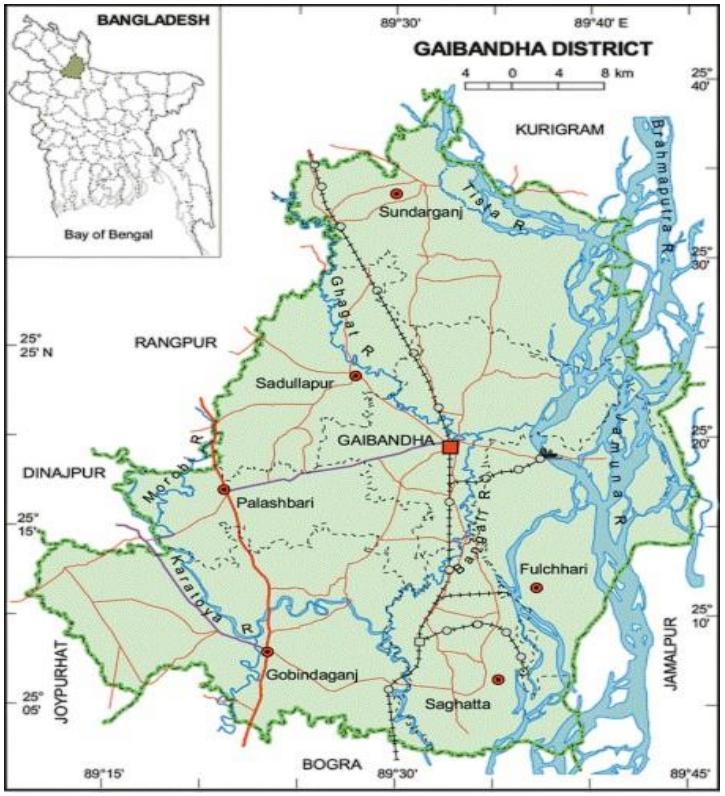

Figure 1. Study Area of Gaibandha District Town.

Data Collection. A sound level meter (REED SD-4023) was employed to measure ambient sound pressure levels in designated regions of Gaibandha city from January 1, 2021, to April 30, 2021. The SD series sound level meter offers triple-range measurement and allows users to pick sample rates ranging from 1 to 3600 seconds. A user may utilize an SD card (up to 16 GB) to set the proper sampling rate and swiftly produce an Excel file containing raw data, all without requiring software. Optional accessories comprise a tripod and AC adapter for uninterrupted long-term monitoring, as well as PC software that enables users to monitor live measurements. The survey was administered on weekdays. The assessment was conducted for the principal traffic junction in the city. The sound pressure level in the traffic zone was assessed using A-weighting.

Measuring Procedure and Analysis. The data recording function captures the highest and lowest values. Press the REC button once to initiate the Data Record function, and a ―REC‖ sign will be shown. The screen will exhibit the "REC" symbol. 1. Press the REC button once, and a "REC. MAX." indicator accompanied by the maximum value will be shown. To remove the maximum value, push the Hold Button once; the display will then exhibit a ―REC.‖ sign and constantly perform the memory function. 2. Press the REC button once more, and a ―REC. MIN.‖ sign accompanied by the minimal number will be shown. To eliminate the minimum value, push the Hold Button once; the display will then exhibit a ―REC.‖ sign exclusively and will continually perform the memory function. 3. To terminate the memory recording feature, press the REC button for 2 seconds. The display will return to the present reading. The data was obtained at a height above 1.5 meters from the ground while positioned on the roadway. All forms of noise barriers were eliminated during the measurement of the real sound level. Data was sampled every second, with a total sampling duration of 5 minutes for each station. Recorded data was saved on a microSD card. The gathered data were analyzed using Microsoft Excel version 2010 and IBM SPSS version 20. All data are

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represented in various graphs and tables according to different versions of ArcGIS v.10. Version 2.1 was utilized to generate a research area map and a noise buffering map.

RESULT AND DISCUSSION

In Gaibandha District Town, the Leq was determined to be 89.31 dBA, and the mean noise level was found to be 71.33 dBA.

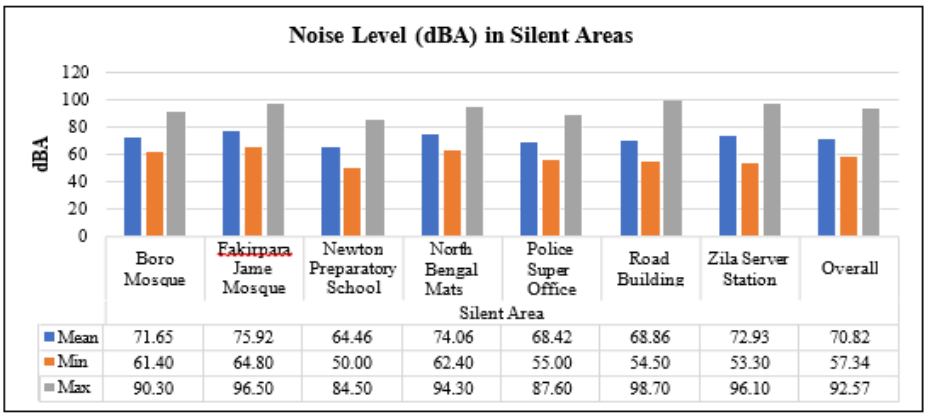

Figure 2. Noise Level (dBA) in Silent Areas.

Analysis of data from 7 points in the silent area of Gaibandha District Town shows that, as illustrated in Figure 2, the maximum noise recorded was 98.70 dBA at Road Building, whereas the minimum noise level was recorded in the Newton Preparatory School, which was 50 dBA. Additionally, the mean noise level in the silent zone was found to be 70.82 dBA. The analysis also found that the highest mean noise level was 75.92 dBA in the Fakirpara Jame Mosque, and the lowest mean noise level was 64.46 dBA in the area of Newton Preparatory School.

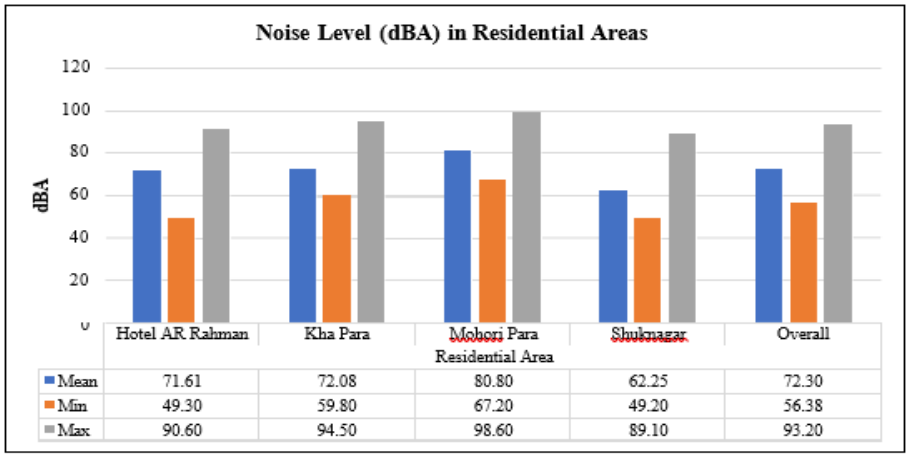

Figure 3. Noise Level (dBA) in Residential Areas.

Figure 3 displays the noise levels at 4 locations in the residential area of Gaibandha District Town. The mean noise level in the residential area was found to be 72.30 dBA. Furthermore, the maximum noise level was recorded at Mohori Para, which was 98.60 dBA, and the minimum noise

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level was recorded at Shuknagar, which was 49.20 dBA. Moreover, the highest mean noise level was found to be 80.80 dBA in Mohori Para, and the lowest mean noise level was 62.25 dBA in Shuknagar.

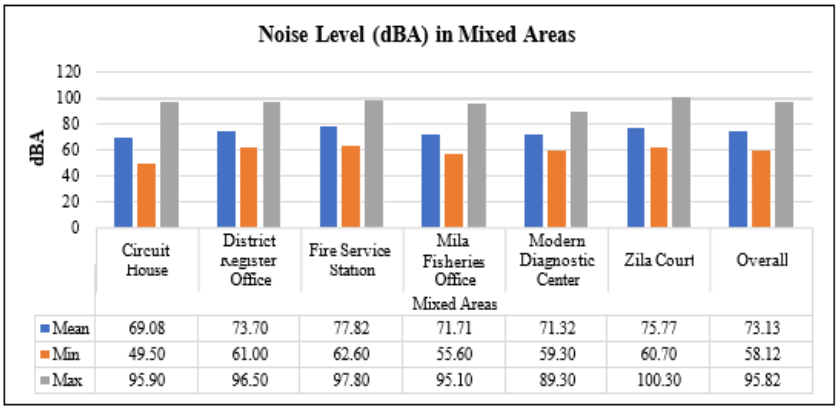

Figure 4. Noise Level (dBA) in Mixed Areas.

Figure 4 illustrates the noise levels of 6 locations in the mixed areas of Gaibandha District Town. The mean noise level in the mixed areas was recorded at 73.13 dBA. Furthermore, the maximum noise level was discovered to be 100.30 dBA at Zila Court, and the minimum noise level was 49.50 dBA at Circuit House. Moreover, the highest mean noise level was reported at 77.82 dBA at the Fire Service Station, whereas the lowest mean noise level was found to be 69.08 dBA at Circuit House.

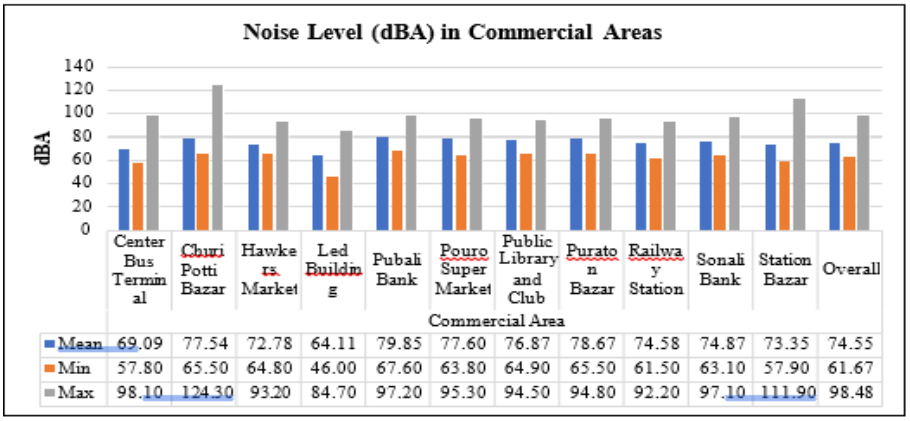

Figure 5. Noise Level (dBA) in Commercial Areas.

Figure 5 explores the noise levels of 11 locations in the commercial area of Gaibandha District Town. The mean noise level in the commercial area was found to be 74.55 dBA. The maximum noise level was found in Churi Potti Bazar (124.30 dBA), while the minimum noise level was found in Led Building (46 dBA). Moreover, the highest mean noise level was recorded in Pubali Bank (79.85 dBA), whereas the lowest mean noise level was discovered in Led Building (64.11 dBA).

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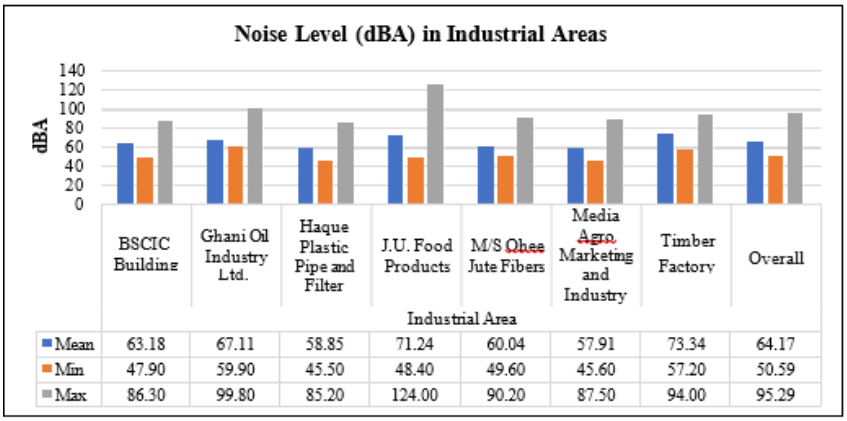

Figure 6. Noise Level (dBA) in Industrial Areas.

Figure 6 depicts noise levels at 7 locations in the industrial area of Gaibandha District Town. The mean noise level in the industrial area was found to be 64.17 dBA. Furthermore, the maximum noise level was found in J.U. Food Products (124 dBA), and the minimum noise level was identified in Haque Plastic Pipe and Filter (45.50 dBA). Moreover, the highest mean noise level was observed in Timber Factory (73.34 dBA), and the lowest mean noise level was observed in Media Agro Marketing and Industry (57.91 dBA).

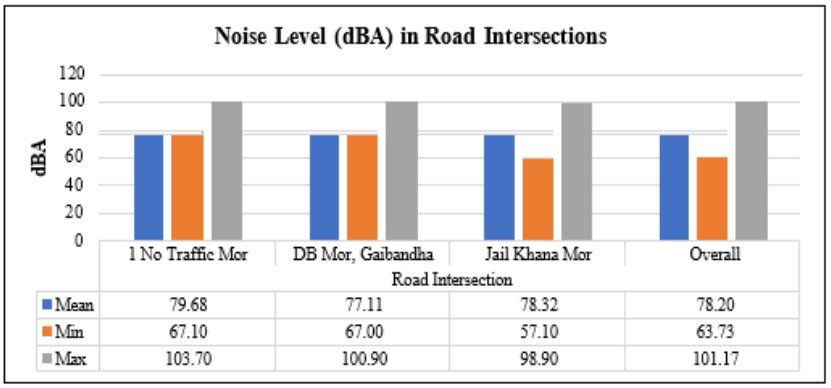

Figure 7. Noise Level (dBA) in Road Intersections.

Figure 7 portrays the noise levels at 3 locations in the road intersection of Gaibandha District Town. The mean noise level in the road intersection was found to be 78.20 dBA. Additionally, the maximum noise level was found in 1 No Traffic Mor (103.70 dBA), and the minimum noise level was identified in Jail Khana Mor (57.10 dBA). Moreover, the highest mean noise level was found in 1 No Traffic Mor (79.68 dBA), whereas the lowest mean noise level was found in DB Mor, Gaibandha (77.11 dBA).

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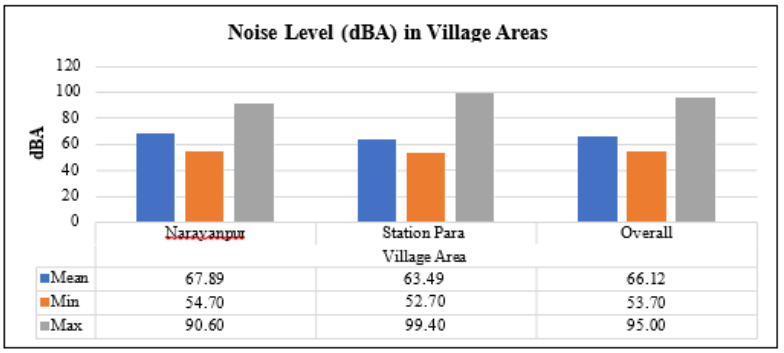

Figure 8. Noise Level (dBA) in Village Areas.

Figure 8 denotes the noise levels between 2 locations in the village area of Gaibandha District Town. The mean noise level in the village area was found to be 66.12 dBA. Furthermore, the maximum noise level was found in Station Para (99.40 dBA), and the minimum noise level was observed in Narayanpur (90.60 dBA). Moreover, the highest mean noise level was reported in Narayanpur (67.89 dBA), and the lowest mean noise level was found in Station Para (63.49 dBA).

Table 1. Dispersion of Noise Quality in Different Land Use in Gaibandha District Town

Land Use (N)	Mean	Minimum	Maximum	Standard Deviation	Range	Median	Rank
Silent Area (7)	70.82	50.00	98.70	7.76	48.70	70.50	5
Residential Area (4)	72.30	49.20	98.60	9.40	49.40	73.60	4
Mixed Areas (6)	73.13	49.50	100.30	7.81	50.80	72.80	3
Commercial Area (11)	74.55	46.00	124.30	8.41	78.30	74.40	2
Industrial Area (7)	64.17	45.50	124.00	10.43	78.50	63.40	7
Road Intersection (3)	78.20	57.10	103.70	6.80	46.60	77.80	1
Village Area (2)	66.12	52.70	99.40	9.98	46.70	62.40	6
Overall (40)	71.33	45.50	124.30	9.68	78.80	71.80	-

Table 1 presents the descriptive statistics for the noise quality of the study. The study encompasses 7 distinct land uses. The highest mean was found at the road intersection (78.20 dBA), and the lowest mean was found in the industrial area (64.17 dBA). Conversely, the industrial area (78.50 dBA) has the highest ranges, while the road intersection (46.60 dBA) has the lowest ranges. From the comparison of mean, standard deviation, and coefficient of variation, it was observed that the highest variation was in the industrial zone, which means that due to the various activities in this zone, the noise level varies a lot.

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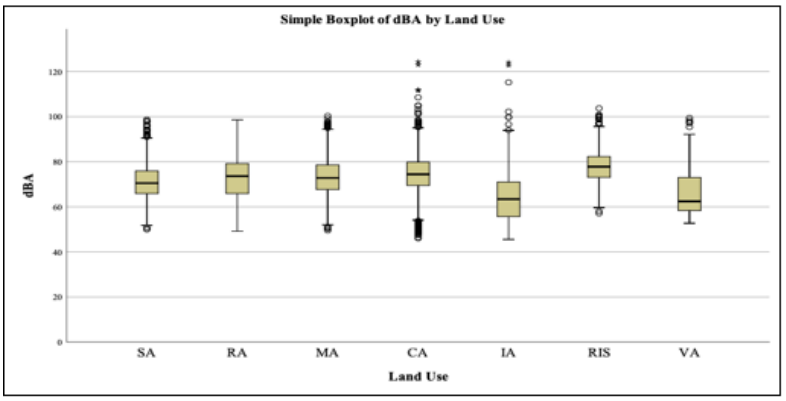

Figure 9. Mean Noise Pollution in Gaibandha District Town.

The whisker box plot (Figure 9) shows the mean noise pollution in Gaibandha District Town. A horizontal black line marks the median. The lower boundary of the box indicates the 25th percentile. The 75th percentile can be found at the box's upper edge. The whisker represents the maximum (upper whisker) and minimum value (lower whisker). Points above the whiskers indicate outliers.

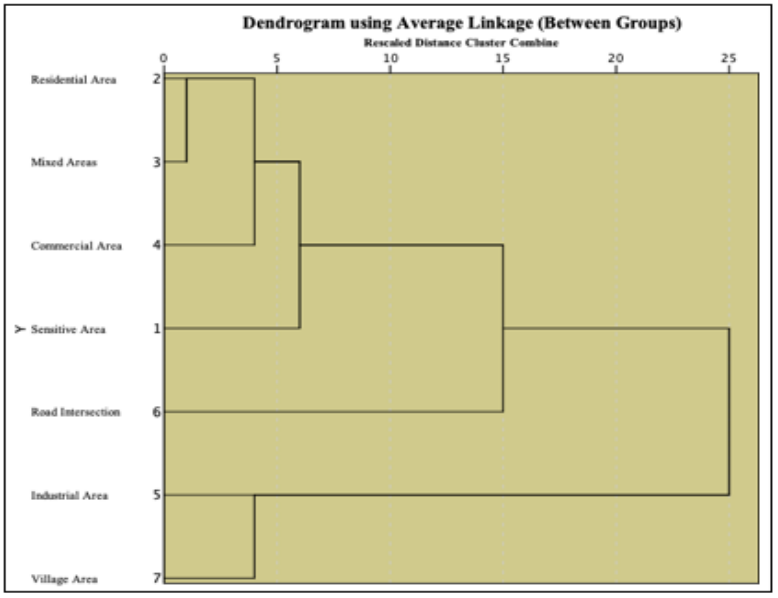

Figure 10. Land Use-Based Cluster, in Terms of dBA.

Figure 10 shows the land-use-based cluster in terms of dBA. Residential areas and mixed areas are in the first cluster. The second cluster includes commercial areas. Moreover, the industrial and village areas are shown in the final cluster.

Table 2. Post-hoc Analysis

(I) Land Use	(J) Land Use	Mean Difference (I-J)	Standard Error	Sig.
Silent Area	Residential Area	-1.4847*	0.29976	0
	Mixed Areas	-2.3150*	0.26131	0
	Commercial Area	-3.7309*	0.23548	0

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Residential Area	Industrial Area	6.6505*	0.25297	0
	Road Intersection	-7.3879*	0.35183	0
	Village Area	4.6945*	0.36033	0
	Silent Area	1.4847*	0.29976	0
	Mixed Areas	-.8303*	0.30219	0.006
	Commercial Area	-2.2461*	0.28015	0
	Industrial Area	8.1353*	0.29501	0
	Road Intersection	-5.9032*	0.38318	0
	Village Area	6.1792*	0.39099	0
	Silent Area	2.3150*	0.26131	0
	Residential Area	.8303*	0.30219	0.006
	Commercial Area	-1.4158*	0.23856	0
	Industrial Area	8.9656*	0.25585	0
	Road Intersection	-5.0729*	0.35391	0
	Village Area	7.0095*	0.36235	0
	Silent Area	3.7309*	0.23548	0
	Residential Area	2.2461*	0.28015	0
	Mixed Areas	1.4158*	0.23856	0
	Industrial Area	10.3814*	0.2294	0
	Road Intersection	-3.6570*	0.33529	0
	Village Area	8.4254*	0.34419	0
	Silent Area	-6.6505*	0.25297	0
	Residential Area	-8.1353*	0.29501	0
	Mixed Areas	-8.9656*	0.25585	0
Mixed Areas	Commercial Area	-10.3814*	0.2294	0
	Road Intersection	-14.0384*	0.3478	0
	Village Area	-1.9560*	0.35639	0
	Silent Area	7.3879*	0.35183	0
	Residential Area	5.9032*	0.38318	0
	Mixed Areas	5.0729*	0.35391	0
	Commercial Area	3.6570*	0.33529	0
	Industrial Area	14.0384*	0.3478	0
	Village Area	12.0824*	0.43221	0
	Silent Area	-4.6945*	0.36033	0
	Residential Area	-6.1792*	0.39099	0
	Mixed Areas	-7.0095*	0.36235	0
	Commercial Area	-8.4254*	0.34419	0
	Industrial Area	1.9560*	0.35639	0
	Road Intersection	-12.0824*	0.43221	0

Based on observed means.
The error term is Mean Square (Error) = 81.720.
* The mean difference is significant at the 0

Table 2 depicts significant differences in the 7 distributed land uses. The mean differences at specific land uses are significantly lower, with significance determined at the 0.05 level.

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Table 3. Comply with Noise Standard

Land Use (N)	Location	Standard	Within Standard (%)
Silent Area (7)	Boro Mosque	50	0.00%
	Fakirpara Jame Mosque		0.00%
	Newton Preparatory School		0.00%
	North Bengal Mats		0.00%
	Police Super Office		0.00%
	Road Building		0.00%
	Zila Server Station		0.00%
	Mean		**0.00%**
Residential Area (4)	Hotel AR Rahman	55	7.54%
	Kha Para		0.00%
	Mohori Para		0.00%
	Shuknagar		15.07%
	Mean		**5.65%**
Mixed Areas (6)	Circuit House	60	16.09%
	District Register Office		0.00%
	Fire Service Station		0.00%
	Mila Fisheries Office		2.55%
	Modern Diagnostic Center		0.96%
	Zila Court		0.00%
	Mean		**3.27%**
Commercial Area (11)	Center Bus Terminal	70	61.65%
	Churi Potti Bazar		11.50%
	Hawkers Market		34.24%
	Led Building		63.86%
	Pubali Bank		3.81%
	Pouro Super Market		11.65%
	Public Library and Club		12.94%
	Puraton Bazar		5.52%
	Railway Station		29.15%
	Sonali Bank		21.36%
	Station Bazar		38.39%
	Mean		**26.73%**
Industrial Area (7)	BSCIC Building	75	87.25%
	Ghani Oil Industry Ltd.		90.29%
	Haque Plastic Pipe and Filter		91.27%
	J.U. Food Products		62.74%
	M/S Ohee Jute Fibers		95.16%
	Media Agro Marketing and Industry		94.67%
	Timber Factory		57.26%

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Mean	**82.66%**
All Mean	**23.66%**

Table 3 demonstrates that 23.66% of areas in Gaibandha District Town belonged to the noise standard among 5 land uses. No areas in the silent zone met the noise standard across 7 locations, 5.65% of the areas in the residential zone met the noise standard in 4 locations, 3.27% of the areas in the mixed zone met the noise standard across 6 locations, 26.73% of the areas in the commercial zone met the noise standard across 11 locations, and 82.66% of the areas in the industrial zone met the noise standard across 7 locations.

None of the areas in the silent zone met the noise standard, whereas in the residential zone, the Shuknagar area (15.07%) met the highest intensity within the noise standard. The mixed area's data represents the highest at Circuit House (16.09%); conversely, in the commercial area, a 63.86% high intensity was found at Led Building. Moreover, in the industrial area, M/S Ohee Jute Fibers had the highest, at 95.16%, within the standard.

The current study observed 7 land uses, while only 5 were incorporated in the Sound Pollution (Control) Rules—2006. As a result, in the comparison of all land uses with noise standards, village areas and road intersections were excluded.

CONCLUSION

The investigation revealed that all examined sites had noise pollution levels above national regulations. The increase in noise pollution is a significant contributor to both acute and chronic health issues. Consequently, individuals may experience challenges with their physical and emotional well-being, diminishing their overall enjoyment of life. The mean noise level was 71.33 dBA, while the Leq was 89.31 dBA in Gaibandha District Town. Gaibandha District Town's mean noise level ranking was Road Intersection (78.20 dBA) > Commercial Area (74.55 dBA) > Mixed Areas (73.13 dBA) > Residential Area (72.30 dBA)

> Silent Area (70.82 dBA) > Village Area (66.12 dBA) > Industrial Area (64.17 dBA). The highest mean noise level was measured at Mohori Para (80.80 dBA), while the lowest mean noise level was noted at Media Agro Marketing and Industry (57.91 dBA). Noise levels in Gaibandha District Town have recently escalated due to a surge in the number of vehicles and pedestrians. Many individuals are unaware of the detrimental effects of noise pollution on health; hence, it is not regarded as a significant kind of pollution. Noise pollution is a significant issue in Gaibandha, akin to the situation throughout Bangladesh, but it often goes unnoticed by the populace. The government, media, and NGOs must collaborate on coordinated initiatives to enhance living conditions in Bangladesh. We cannot afford to squander time or resources on measures to mitigate noise pollution, particularly given the numerous unnecessary sources. Noise pollution is a significant problem that adversely affects individuals; hence, it can no longer be disregarded. We must all take this matter seriously and take action to protect the future of our children, as well as the health, safety, and welfare of the public. All individuals, encompassing the general populace, NGO personnel, and media representatives, bear the responsibility to mitigate noise pollution. Further research on noise pollution in Gaibandha District Town is necessary to guarantee sustainable living conditions for its residents.

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