

A Comparative Study of Sound Level in Two Cities Gazipur and Cox's Bazar

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Abstract

Urban environments are increasingly being dominated by noise, an undesirable byproduct of urbanization. Due to poor traffic management and rapid urbanization, noise pollution in Bangladesh's major cities and their surrounding areas has increased tremendously. Many studies are currently being conducted to find ways to make noise pollution less harmful to people's health. This study compares noise levels in Gazipur City on weekdays with Cox's Bazar City during holidays, both during peak and off-peak hours. Gazipur's industrial and educational nature makes it busier on weekdays, resulting in higher noise levels. Cox's Bazar, being a tourist destination, gets busier on holidays and should maintain average sound levels to ensure a pleasant experience for visitors. Study data showed that regardless of noise-producing sources, Cox's Bazar City remains much noisier during holidays. The values are taken from the roadside, and a total of 30 locations have been used as measuring sites in both cities. The aim of this research is to identify the possible causes of noise pollution in both cities and reduce the noise level. In Gazipur City, during peak hours, the recorded maximum and minimum noise densities were 112.91 dB and 91.11 dB, respectively. In off-peak hours, the maximum and minimum noise densities were 103.60 dB and 83.58 dB, respectively. In Cox's Bazar City, the measured maximum and minimum noise densities during peak hours were 125.80 dB and 86.63 dB, respectively. But in off-peak hours, the maximum and minimum noise densities were 88.25 dB and 49.90 dB, respectively. This the study suggests that some physical methods to reduce noise levels in cities, particularly in crowded tourist cities like Cox's Bazar.

Keywords: Noise Pollution; Off-Peak hour; Passenger Car Unit (PCU); Decibel (dB); Peak hour;

1 Introduction

In recent years, noise pollution has gained increasing attention worldwide due to its adverse effects on human health and the environment. Noise, defined as unwanted or excessive sound, has become a pervasive problem in urban and industrial areas, often reaching alarming levels that exceed recommended thresholds. With the rapid urbanization and industrialization witnessed in many developing countries, including Bangladesh, the detrimental consequences of noise pollution have become a pressing concern. This research paper investigates the extent of noise pollution in two significant locations in Bangladesh: Gazipur and Cox's Bazar. Gazipur, a major industrial district, is characterized by a high density of manufacturing units, while Cox's Bazar, a popular tourist destination, experiences noise pollution from various recreational activities. By assessing noise levels and analyzing their impacts on human health and the environment, this study sheds light on the severity of the problem and provides insights for effective mitigation strategies. Smith et al. (2019) conducted a comprehensive investigation on the correlation between high noise levels and increased stress levels among urban residents. Their findings suggested a significant association between exposure to noise pollution and adverse health outcomes, such as cardiovascular diseases and sleep disturbances. Moreover, Rahman and Ahmed (2020) examined the noise pollution levels in major industrial areas of Bangladesh and identified a concerning rise in noise-related complaints and health issues among workers and nearby communities. Their study emphasized the urgent need for noise control measures and effective enforcement of regulations in industrial zones. Another noteworthy study by Ali et al. (2018) explored the ecological impacts of noise pollution in coastal areas. They observed a significant disruption in marine ecosystems due to anthropogenic noise, leading to alterations in the behavior and migration patterns of marine species. The study highlighted the importance of considering noise pollution as a potential threat to biodiversity and ecosystem stability. Islam et al. (2017) conducted a study on noise pollution in Dhaka, the capital city of Bangladesh, and found that noise levels exceeded the permissible limits in various areas, leading to negative health effects among residents, including increased stress levels and annoyance.

Khan et al. (2020) investigated the impact of noise pollution on the quality of life in residential areas near major highways in Bangladesh. Their findings revealed a significant decrease in the overall quality of life due to noise related disturbances, affecting sleep patterns, communication, and overall well-being. Akhtar et al. (2019) examined the effects of noise pollution on cognitive performance among primary school students in urban areas of Bangladesh. The study revealed a lack of knowledge and understanding regarding the adverse effects of noise pollution, emphasizing the importance of public education and awareness campaigns. Jahan et al. (2018) investigated the impact of noise pollution on the productivity of workers in textile mills in Bangladesh. The study indicated a significant decline in productivity levels due to noise-related distractions and increased stress levels among workers. By building upon these previous research findings and conducting our own comprehensive analysis, this study aims to provide a deeper understanding of the noise pollution situation in Gazipur and Cox's Bazar. Furthermore, this study intends to highlight the multifaceted impacts of noise pollution on human health, including physical and psychological effects, as well as its consequences on the environment and the need for urgent action.

2 Methodology

The methodology for the comparative analysis of noise levels in Gazipur and Cox's Bazar cities, Bangladesh, is as follows: A background study was conducted by reviewing existing literature on noise pollution in Dhaka, Bangladesh, as well as international research papers. The purpose of the study was to compare the noise levels between Gazipur, an industrial city, and Cox's Bazar, a tourist spot. To collect data, specific locations were selected in both cities to ensure the representation of their respective areas. Sound Level Meter (SLM) was used to measure the noise levels accurately. Data were collected in 30 locations during both peak and off-peak hours to capture variations in noise levels throughout the day. Both cities assumed peak hours to be from 9:00 AM to 11:00 AM and 5:00 PM to 9:00 PM, while off-peak hours were considered to be from 11:00 AM to 5:00 PM and 9:00 PM to 11:00 PM. The collected data were subjected to statistical analysis using the *IBM SPSS Statistics* to determine the noise levels in Gazipur and Cox's Bazar. A comparative analysis was performed, examining the noise levels during peak and off-peak hours in both cities. Appropriate analytical techniques were applied to identify significant differences or trends in the data. The results of the analysis, including the recorded noise levels in Gazipur and Cox's Bazar, were presented. Variations between peak and off-peak hours in both cities were highlighted. Graphical representations, tables, or statistical summaries were utilized to support the presentation of the results. Any limitations or constraints encountered during the study were also addressed. Tailored measures were suggested for the industrial area of Gazipur and the tourist spots of Cox's Bazar. Best practices and successful interventions were taken into consideration when proposing strategies for noise reduction and management. By following this methodology, the study aimed to offer valuable insights into the noise levels in Gazipur and Cox's Bazar and provide recommendations to address the issue of noise pollution in these urban areas.

2.1 Research Area

The research area for this study focuses on investigating the noise levels in two distinct cities, namely Gazipur and Cox's Bazar, in Bangladesh. These cities were selected due to their unique characteristics and significance in terms of noise pollution. Gazipur, known for its industrial activities, as shown in Figure 1, experiences significant noise levels that impact the surrounding environment and residents. The study aims to gain insights into the extent of noise pollution in Gazipur, analyze its effects on the local community, and propose measures to mitigate the adverse impacts. By understanding the noise dynamics in Gazipur, effective noise management strategies can be developed to improve the overall quality of life for the city's residents. Cox's Bazar, a renowned tourist spot, as shown in Figure 2, faces challenges related to noise pollution stemming from various activities associated with tourism. The study aims to examine the noise levels in Cox's Bazar, assess their impact on the environment, and propose strategies to minimize noise-related issues. By understanding the specific noise challenges in Cox's Bazar, the research can contribute to enhancing the experience for tourists and ensuring the well-being of the local community. By conducting a comparative analysis of noise levels in Gazipur and Cox's Bazar, the research aims to provide a comprehensive understanding of the source of noise pollution situation in different urban contexts. This knowledge can serve as a basis for formulating targeted noise management approaches tailored to the specific needs of each city. Ultimately, the findings of this study have the potential to contribute to sustainable urban development by addressing noise pollution concerns and fostering a healthier and more livable environment for the residents of Gazipur and Cox's Bazar.

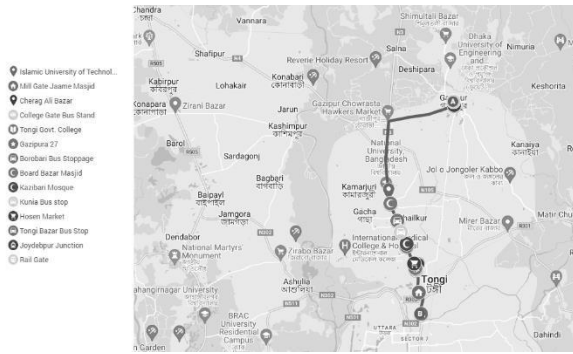


Figure 1: Locations of the research area in Cox's Bazar



Figure 2: Locations of the research area in Gazipur City

3 Results and Discussion

Investigation into the sources of noise resulted that Gazipur recognized as an industrial area, experiences heightened levels of noise due to the presence of numerous industries, factories, and manufacturing units. The industrial activities in Gazipur contribute to the generation of substantial noise, including the operation of heavy machinery, transportation of goods, and the overall hustle and bustle associated with industrial operations. Consequently, noise pollution in Gazipur has become a critical concern, affecting the well-being and quality of life of residents in the vicinity. In contrast, Cox's Bazar, widely known as a popular tourist destination, experiences a unique soundscape shaped by the influx of visitors and the specific activities associated with tourism. The city attracts a large number of tourists, both local and international, seeking to explore its pristine beaches, indulge in recreational activities, and enjoy the vibrant entertainment scene. Consequently, the diverse range of tourist-related activities contributes to the overall noise levels in Cox's Bazar.

Table 1: Average Noise level (dB) at different locations in Gazipur City

Location Name	Tongi Govt. College	Tongi Bus Stand	Rail Gate	Mill Gate Road	Kunia Mosque	Kazibari	Joydebpur Junction	Islamic University of Technology
Peak hours	106.23	109.31	103.15	107.71	91.23	96.65	112.91	108.10
Off-Peak hours	99.82	103.60	98.53	93.18	83.80	92.12	100.11	100.72
Mean	100.51	107.42	101.25	96.20	90.11	94.00	105.60	104.13

Location Name	Hosen Market	Gozalishah Road Rail Crossing	Gazipura Bus Station	College Gate	Cherag Ali	Borobari	Board Bazar Mosque
Peak hours	99.58	104.64	100.00	92.21	103.26	91.11	102.30
Off-Peak hours	92.47	79.36	88.23	90.25	89.36	83.58	99.28
Mean	96.20	80.25	90.77	91.02	93.25	86.29	100.54

Table 1 presents the collected noise level data from 15 different locations in Gazipur City during peak and off-peak hours, along with their corresponding mean values. The objective of this data collection was to assess the noise pollution levels across various areas and identify the factors contributing to these variations. During peak hours, the Joydebpur Junction area emerged as the noisiest location, recording a high noise level of 112.91 dB. This can be attributed to multiple noise sources, including the significant flow of vehicles passing through the junction and the presence of nearby industrial activities. The combined effect of heavy traffic and industrial noise sources contributes to the heightened noise levels experienced in this area. In contrast, the Borobari area exhibited relatively lower noise levels, with a reading of 91.11 dB during peak hours. This can be attributed to the fact that the noise sources from vehicles in this area were comparatively fewer than at the Joydebpur Junction. The reduced

traffic volume contributes to a quieter environment in Borobari during peak hours. Analyzing the data for off-peak hours, it is important to note that noise levels are generally lower across all locations compared to peak hours. However, the Tongi Bus Stand emerged as the noisiest location during off-peak hours, with a reading of 103.60 dB. This can be attributed to factors such as ongoing commercial activities, transportation hubs, or other localized noise sources present in that area. In comparison, Borobari remained one of the quieter areas.

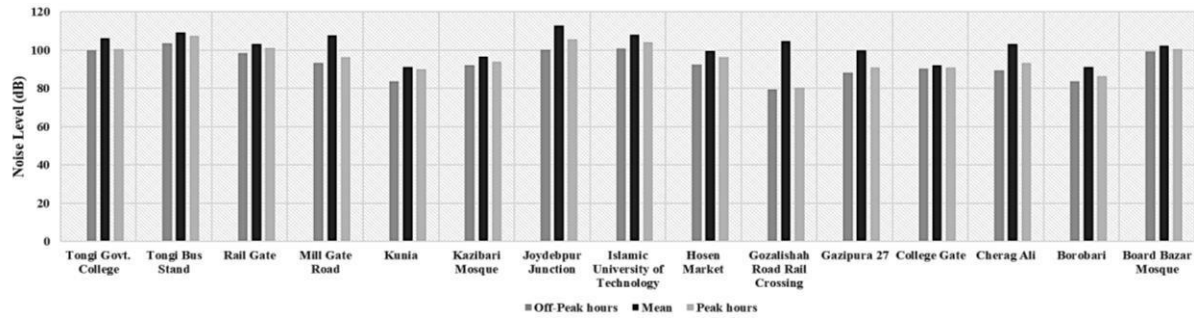


Figure 3: Comparison of Noise Levels in Gazipur City: Peak Hours, Off-Peak Hours, and Mean Values across Different Locations

The column charts, as shown in Figures 3 and 4, illustrate a comparison of noise levels in various locations within Gazipur City and Cox’s Bazar during both peak and off-peak hours, along with the corresponding mean values. The charts allow for a visual understanding of the variations in noise pollution across different areas. The vertical axis represents the noise level in decibels (dB), while the horizontal axis denotes the specific locations. The chart provides separate bars for each location, indicating the noise level during peak and off-peak hours, as well as the mean value. By inputting the actual noise level values on the chart, one can assess the relative noise levels in different areas and observe any significant differences between peak and off-peak hours. The chart offers a clear overview of the noise pollution landscape, allowing for a better understanding of the noise levels experienced in different locations in both cities.

Table 2: Average Noise level (dB) at different locations in Cox’s Bazar

Location Name	Bangla Bazar	Cox’s Polytechnic Institute	Dolphin Mor	Dorgah Para	Himchori	Inani Beach	Kolatoli Beach	Kakra Beach
Peak hours	91.53	94.30	115.62	89.28	88.30	86.63	104.66	88.20
Off-Peak hours	88.25	61.43	75.89	58.56	63.50	60.30	63.45	62.10
Mean	90.23	78.62	88.23	72.12	74.25	68.11	76.58	73.74

Location Name	Laboni Point	Cox’s Bazar Link Road	Cox’s Bazar Bus Terminal	Cox’s Bazar Police lines	Shaibal Beach	Sonar Para Bazar	Sugandha Point
Peak hours	99.92	104.64	125.80	110.02	98.22	88.74	96.25
Off-Peak hours	60.60	79.36	63.20	86.41	49.90	68.25	76.98
Mean	76.85	83.26	87.50	88.68	71.24	71.03	73.68

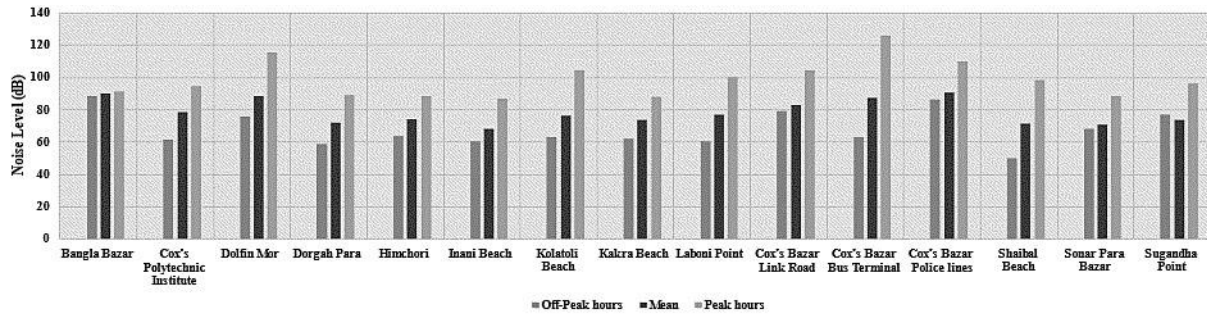


Figure 4: Comparison of Noise Levels in Cox's Bazar: Peak Hours, Off-Peak Hours, and Mean Values across Different Locations

Table 2 provides a comprehensive overview of the noise levels recorded at 15 different locations within Cox's Bazar City during both peak and off-peak hours, along with the corresponding mean values. The data analysis uncovers fascinating insights into the city's noise pollution landscape.

Notably, the Cox's Bazar Bus Terminal area emerged as the location with the highest noise level, reaching a concerning 125.80 dB during peak hours. This can be attributed to the heavy traffic flow associated with school buses, office buses, and tourist vehicles entering and leaving the terminal. The volume of traffic in this area contributes significantly to the elevated noise levels observed during peak hours. Additionally, the study was conducted on holiday, which might have further intensified the noise levels due to increased tourist activity in Cox's Bazar. In contrast, the Kakra Beach area displayed the lowest noise level among all the locations, measuring 88.20 dB. The relatively tranquil environment in this area during peak hours can be attributed to the absence of nearby schools or offices, resulting in reduced vehicular and human activity. Kakra Beach primarily attracts tourists with a specific interest in beach experiences, as Cox's Bazar boasts numerous other captivating beaches within the city. In terms of off-peak hours and the arithmetic mean, the Bangla Bazar area emerged as the noisiest location among all the recorded locations in the city. Irrespective of whether it was peak or off-peak hours, the noise levels remained consistently high in Bangla Bazar. This can be attributed to various factors contributing to the constant noise in the area. The presence of a large number of tourists and their vehicular movement around Bangla Bazar significantly contributes to noise pollution. The bustling activity and congestion caused by the influx of tourists create a noisy environment. Additionally, locals in the area often use various musical instruments and loudspeakers to attract the attention of tourists, further adding to the noise levels. The data collected from Bangla Bazar supports these observations, with noise levels recorded at 91.53 dB during peak hours and 90.23 dB during off-peak hours. Moreover, the mean noise level of 88.25 dB indicates the persistent and continuous noise experienced in this area.

Table 3: Comparison of Standard Noise Levels and Current Study Findings

Land Use	Standard Noise level (dB)	Current Study		Comments
		Mean Noise level (dB)	Places	
Bus Terminal	55 dB (Day)	87.50 dB, 107.4 dB, 105.60 dB	Cox's Bazar Bus Terminal, Tongi Bus Stand, Joydebpur Junction	Not Satisfied
	45 dB (Night)			-----
Industrial Area	70 dB (Day)	96.20 dB, 90.11 dB, 90.77 dB	Mill Gate Road, Kunia, Gazipura Bus Station	Not Satisfied
	60 dB (Night)			-----

Table 3 represents the comparison between the current study findings and the standard noise level recommended by the WHO. Retrieved from World Health Organization (2018) Environmental noise guidelines for the European Region, since there is no specific guideline of WHO regarding the Asian region on the noise level. Data found in this study indicate alarming concern in almost all the locations as they are facing a noise level value more than the recommended one.

5 Conclusions

The investigation of the sources of noise in Gazipur and Cox's Bazar revealed that industrial activities in Gazipur and tourism-related activities in Cox's Bazar contribute to the generation of substantial noise, resulting in heightened levels of noise in the areas. The collected noise level data from different locations in Gazipur City and Cox's Bazar during peak and off-peak hours, along with their corresponding mean values, showed that certain areas in both cities are significantly noisier than others. The Cox's Bazar Bus Terminal area emerged as the location with the highest noise level, reaching a concerning 125.80 dB during peak hours, while the Kakra Beach area displayed the lowest noise level among all the locations, measuring 88.20 dB. In terms of off-peak hours and the arithmetic mean, the Bangla Bazar area emerged as the noisiest location among all the recorded locations in the city. The presence of a large number of tourists and their vehicular movement around Bangla Bazar significantly contributes to noise pollution. The data collected from Bangla Bazar supports these observations, with noise levels recorded at 91.53 dB during peak hours and 90.23 dB during off-peak hours. Moreover, the mean noise level of 88.25 dB indicates the persistent and continuous noise experienced in this area. The study highlights the need for effective measures to mitigate noise pollution in Gazipur and other urban areas in Bangladesh. The data found in this study indicate alarming concern in almost all the locations as they are facing a noise level value more than the recommended one by the World Health Organization (WHO). The study emphasizes the importance of reducing noise levels and implementing measures to promote a greener environment to reduce noise pollution.

6 Recommendations

There are several ways to reduce noise pollution. One way is to install sound-absorbing barriers or walls strategically around the area. These barriers can help block or reduce the transmission of sound waves, creating quieter areas within the vicinity. Another way is to introduce green spaces and vegetation, such as trees, hedges, and shrubs, which can act as natural sound absorbers and can be appropriate beside the roads. Vegetation helps in absorbing and scattering sound waves, reducing noise levels. Implementing traffic management strategies to control the flow of vehicles and reduce noise from honking and engine noise is also important. Improving public transportation infrastructure and services to make them more efficient and accessible is also important. There are acoustic materials available that can be used for walkways, pavements, and public spaces to help minimize noise propagation. Establishing and enforcing noise regulations specific to the tourist spot is another way to reduce noise pollution. Setting noise limits for commercial establishments, construction activities, and public events and ensuring compliance through monitoring and penalties is important. Retrofitting existing buildings and structures with soundproofing materials and techniques to reduce noise transmission from within and outside the premises is also a good idea. Sound absorbing materials for stages or performance areas to contain the sound is also important. Finally, conducting public awareness campaigns to educate tourists and visitors about the impact of noise on the environment and the importance of maintaining a quieter atmosphere is important. Encouraging responsible behavior and respectful noise levels is key to reducing noise pollution in tourist spots.

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