

The Status of Noise Pollution of Mymensingh City, Bangladesh: A GIS-Based Noise Mapping

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Abstract: Noise pollution is addressed as a public health issue induced mainly by urbanization. It is a growing problem in developing cities like Mymensingh, the second-most densely populated city in Bangladesh. Noises of this city are primarily generated from different sources like mass gatherings, transport vehicles, loudspeakers, public address systems, festivals etc. The study was conducted at 26 locations, including commercial, sensitive, residential & mixed areas, to analyze the different noise levels from March 6, 2021 to March 14, 2021. GIS (ArcGIS 10.8) with IDW technic was used for detailed noise pollution mapping of the city. Recorded data were compared with Bangladesh Noise Standard (DoE 2006), WHO (2009) and US(EPA) standards. The obtained spatial analytic maps showed that the noise level of this city is higher than the guideline values and hazardous for human health. The highest (93.3 dB) level of sound was observed from Tangail Bus Stand and the lowest (44.9 dB) from Botanical Garden. The final result showed that the ambient noise levels of Mymensingh city areas were far higher than the standard levels. It was acute in overpopulated places and the areas with high traffic and excessive honking horns of various vehicles. This paper suggests that preventive measures should be imposed in extremely noise-polluted areas.

Key Words: Noise pollution, Mymensingh, GIS, Automobiles, Guideline values, Traffic.

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I. Introduction

Noise pollution means the unpleasant loud sounds that exceed the permissible limits and adversely affect human health¹. But this pollution is often considered as overlooked though the consequences are severe for living organisms. The initiation of this pollution mainly started from the mid of the last century due to speedy urbanization. This urbanization acts as an environmental stressor with a high degree of exposure such as noise and air pollution.⁶

In modern society, Noise Pollution is addressed as a public health issue. Noise exposure has a clear association with adverse health effects. Extreme exposure leads to serious health problems, i.e., annoyance, headaches, hypertension, cause disruption of sleep cycles, mental stress, impairing children's cognitive development, cardiovascular disorder, etc.²

The Department of Environment (DoE) of Bangladesh recommended a threshold of the acceptable noise level for different decibel (dB) units, and it is widely known as Noise Pollution (Control) Rules, 2006. The accepted threshold limits are 50dB, 55dB, 60dB, 70dB, and 75dB for sensitive areas, residential areas, mixed areas, commercial areas, and industrial areas respectively.³

The Mymensingh city is the second-most densely populated city of Bangladesh, and noise pollution is also an indispensable part of this developing city.⁴ The massive construction works started when this city was declared a new division in 2015 and the 12th city corporation of this country in 2018. Building and roads constructions have become part of daily life which causes much noise pollution as well as mental disturbances. The increasing number of transportation systems & exhaust systems of automobiles is the primary sound pollution source. The other sources are loudspeakers, commercial activities, religious activities, ceremonials, festivals, public address systems, etc.

The city is small but crowded, and thus noise pollution is impacting human health so adversely. Noise pollution around educational institutions and hospitals is producing multiple problems. It is affecting people both physically and mentally. This paper aims to study and analyze the noise pollution levels in major areas in this city, find out the significant sources of noise pollution, and ultimately produce a noise map using ArcGIS software-based on noise levels.

II. Materials and Methods

Study Area and Noise level sampling Locations:

The Mymensingh city is located on the bank of Brahmaputra river about 120 Kilometers (75 mi) north of the capital Dhaka. This city is considered a major financial center and educational hub of north-central Bangladesh. The total area of this city is 91.315 square kilometers (35.257 sq. mi).¹¹ The study area is shown in Figure 1.

Noise levels have been measured at twenty-six central locations in Mymensingh City. Noise data were taken from three shifts such as morning (9 AM-10 AM), afternoon (12 PM-2 PM), and evening (5 PM-6 PM) on working days. The locations are Zero Point, Zainul Abedin Park, Mymensingh Library, Town-Hall, Ananda Mohan College (AMC), Mymensingh Zilla School, Notun Bazar, Nowmohol, Trishal Bus Stand, Charpara Bus Stand, Mymensingh Medical College Hospital (MMCH), Maskanda Bus Stand, Mymensingh City Bypass, Kewatkhal, China Bridge More, Alia Madrasha, Ganginarpar, Choto Bazar, CK Ghosh Road, Kanchijhuli, Tangail Bus Stand, Railway Station, BAU Residential Area, K.R. Market, Botanical Garden and Jabbarer More. Almost all the locations are in residential and commercial areas. Noise levels have been measured along the roadside.

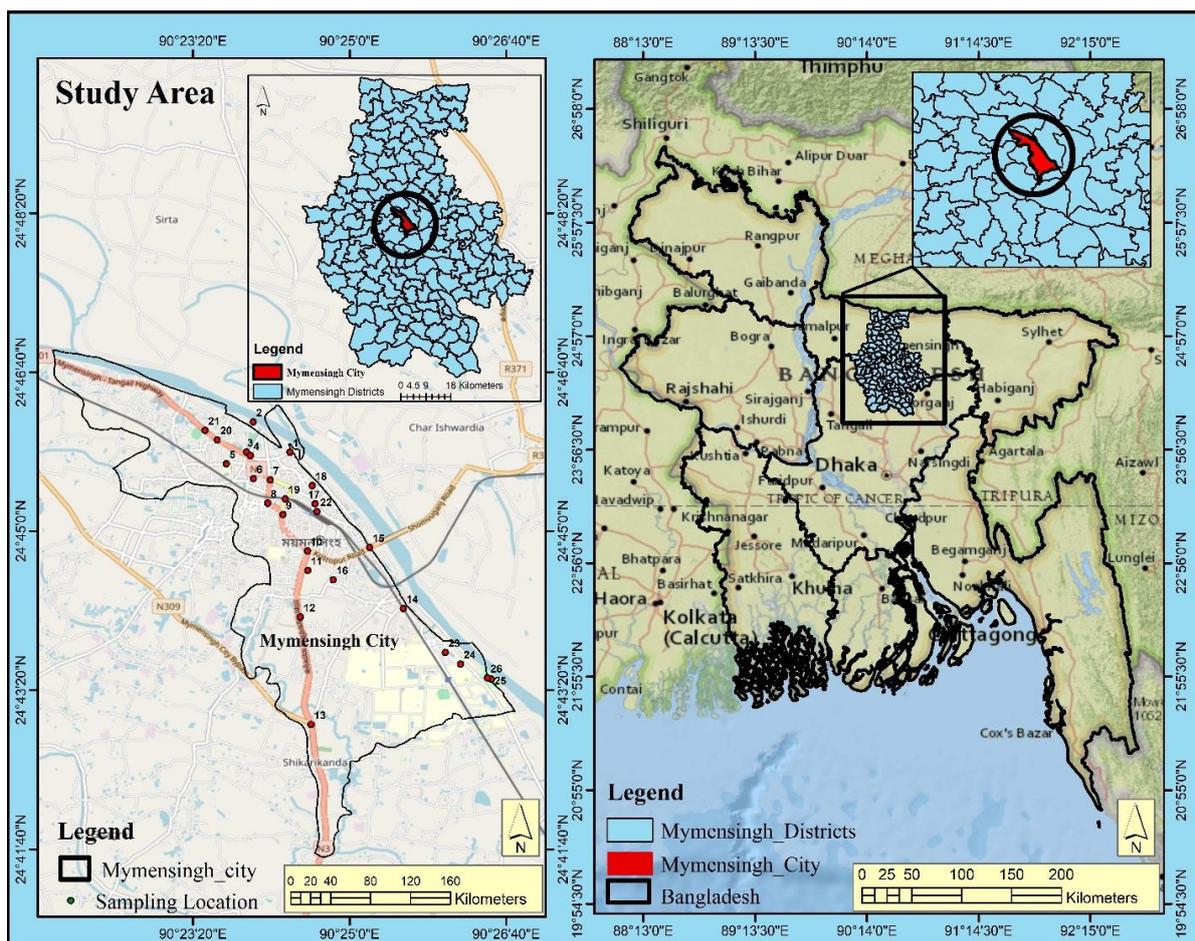


Figure 1: Study Area of Noise Pollution (Mymensingh City)

Instruments Used:

- Sound level meter:** A sound meter is an instrument that measures sound pressure levels. Levels of noise intensity were measured by digital sound level meter 'SKILLTECH', model number SKDEC-01. Measurement range of 30 to 130 dB(A) with an accuracy of ± 1.5 dB (A and C) and resolution 0.1 dB.
- GPS:** The Geographical Positioning System (GPS) device (model: Garmin eTrex 10) was used to obtain coordinates of each location where noise level readings were recorded.
- Arc GIS:** ArcGIS version 10.8 is a geographic information system (GIS) software package maintained by Environmental Systems Research Institute (ESRI).

In this study, we utilize the Inverse Distance Weighting (IDW) interpolation method of spatial analysis tool. The IDW Interpolation is a deterministic method based on the distance among measurement points. It calculates the values in uncovered measurement locations by using existing data within the area covered.⁸

Methodology: The research methodology embraces the selection of study area, observational data collection of noise levels of different essential places and location details related to the individual sampling point. Primary data collection methods were applied to collect the noise levels, but secondary data collection methods were also used to get the geographical information. The Noise levels assessment was based on the field measurement along the roadside. Distances between sites are taken from secondary sources. The collected data are analyzed using GIS (ArcGIS 10.8) software with IDW technic. Finally, the spatial noise pollution maps of the study area of three different timeframes have been produced to get graphical representations of noise pollution of this city.

III. Results and Discussion

The analyses of 26 stations of different locations are presented in Table 1. The various noise pollution sources are attributed to the human gathering, vehicular traffic, particularly auto-rickshaw, and frequent use of the hydraulic-pressure horns by buses and trucks. This study also found that the high noise level occurs during the daytime as people travel to and from schools, markets, and workplaces.

From Table-I, the highest (93.3 dB) level of sound was observed from the Tangail Bus Stand in the afternoon. At noon, it was also observed that this high level of noise pollution is because of the enormous human gatherings, vehicular traffic, and hydraulic horns by buses and tracks. The lowest average noise level (44.9 dB) was found in the morning at the Botanical Garden of Bangladesh Agricultural University. Less human gatherings and restriction of vehicle entrance in the Botanical Garden made it a silent place. The highest noise levels were found in the afternoon and evening at all locations when there were more human gatherings and more vehicles.

Table no 1. Noise levels (dB) at different locations of Mymensingh City with different standards

Sampling Number	Location Name	Category of The Area	Sound Level (dB)			DoE	U.S. (E.P.A.)	W.H.O & E.C.
			Morning	Afternoon	Evening			
1	Zero Point	Commercial	74.9	88.7	88.6	70	60	55
2	Zainul Abedin Park	Sensitive	54.1	65.2	58.9	45	45	45
3	Mymensingh Library	Sensitive	54.6	64	74.8	45	45	45
4	Town Hall	Commercial	76	82.1	86.8	70	60	55
5	Ananda Mohan College	Sensitive	63.7	71	71.2	45	45	45
6	Mymensingh Zilla School	Sensitive	80.9	73.1	73.4	45	45	45
7	Notun Bazar	Commercial	82.6	90.6	85.2	70	60	55
8	Nowmohol	Residential	74.9	90.5	78.1	50	55	55
9	Trishal Bus Stand	Commercial	77	70.1	80.7	70	60	55
10	Chorpara Bus Stand	Commercial	83	83.3	89.5	70	60	55
11	Mymensingh Medical College Hospital	Sensitive	77.2	82.5	87.3	45	45	45
12	Maskanda Bus Stand	Commercial	72.2	85.5	85.3	70	60	55
13	Mymensingh City Bypass	Commercial	73.2	72.6	78.5	70	60	55
14	Kewatkhal	Residential	73.4	72.3	75.8	50	55	55
15	China Bridge More	Commercial	77.7	77.4	79.8	70	60	55
16	Alia Madrassa	Residential	66.4	68.1	67.9	50	55	55
17	Ganginarpar	Commercial	79.2	75.7	81.5	70	60	55
18	Choto Bazar	Commercial	77	77.4	79.3	70	60	55
19	CK Ghosh Road	Commercial	68.6	72.2	73.5	70	60	55
20	Kanchijhuli	Commercial	83.7	87.4	82	70	60	55
21	Tangail Bus Stand	Commercial	68.5	93.3	83.7	70	60	55
22	Railway Station	Commercial	68.9	61.3	69.7	70	60	55
23	BAU Residential Area	Residential	47.2	49.1	66.6	50	55	55
24	K.R. Market	Commercial	61.8	66.6	61.3	70	60	55

25	Botanical Garden	Sensitive	44.9	49.9	49.8	45	45	45
26	Jabbarer More	Commercial	76.1	71.2	68.1	70	60	55

[Note: DoE = Department of Environment (Bangladesh),³ U.S. (E.P.A.) = United States (Environmental Protection Agency)¹⁰,
W.H.O = World Health Organization¹⁰, E.C. = European Commission¹⁰]

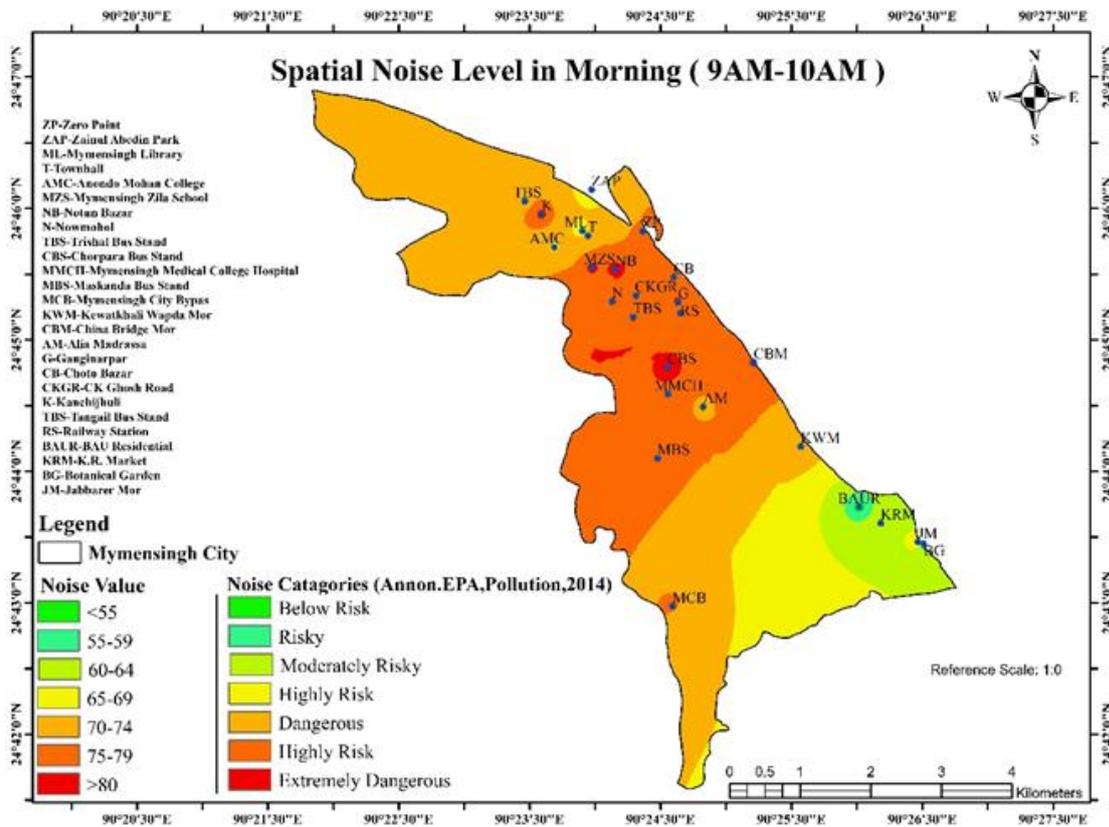


Figure 2. Spatial Noise Mapping in Mymensingh City on Morning using IDW

Figure 2 shows that the highest noise level (82.6 dB) was found in the morning (9 AM – 10 AM) near Notun Bazar and the lowest level (44.9) was found in the morning (9 AM – 10 AM) near Botanical Garden.

Figure 3, In afternoon hours (12 PM-2 PM), the highest noise level (93.3 dB) was found in Tangail Bus Stand and the lowest noise level (49.1 dB) in BAU Residential Area. Same as Evening Hours (4 PM-5 PM) in fig.6, the highest noise level (89.5 dB) was observed in Charpara Bus Stand and the lowest noise level (58.9 dB) in Zainul Abedin Park.

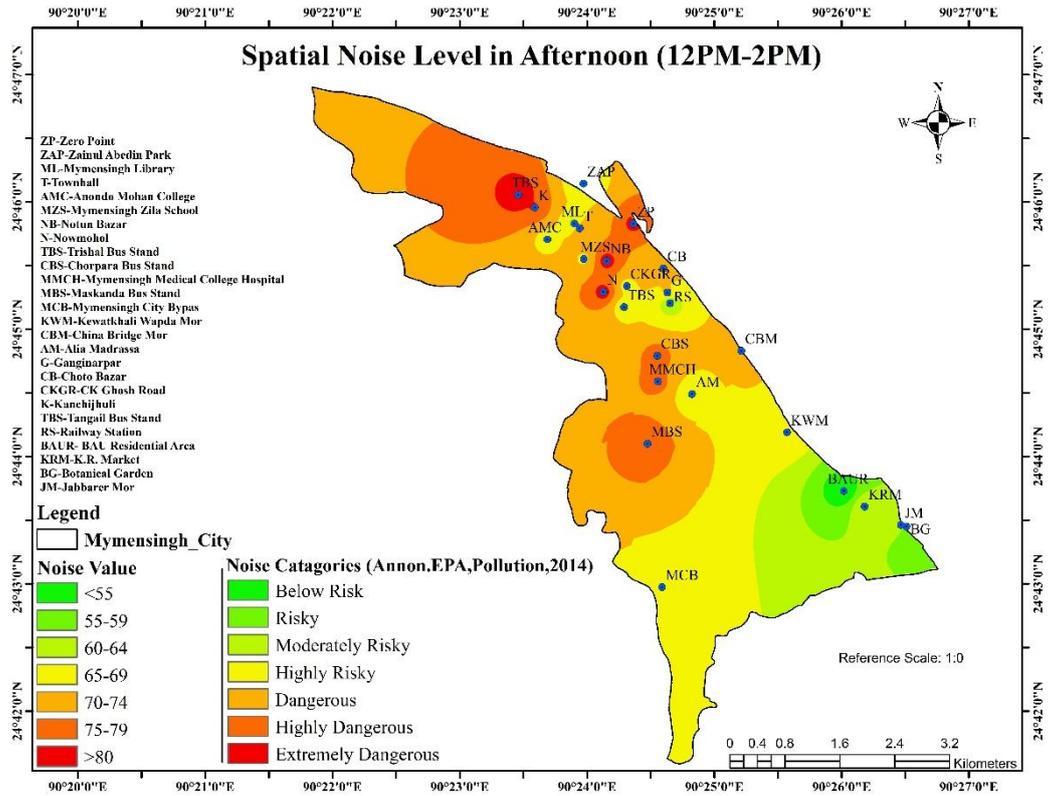


Figure 3. Spatial Noise Mapping in Mymensingh City on afternoon using IDW.

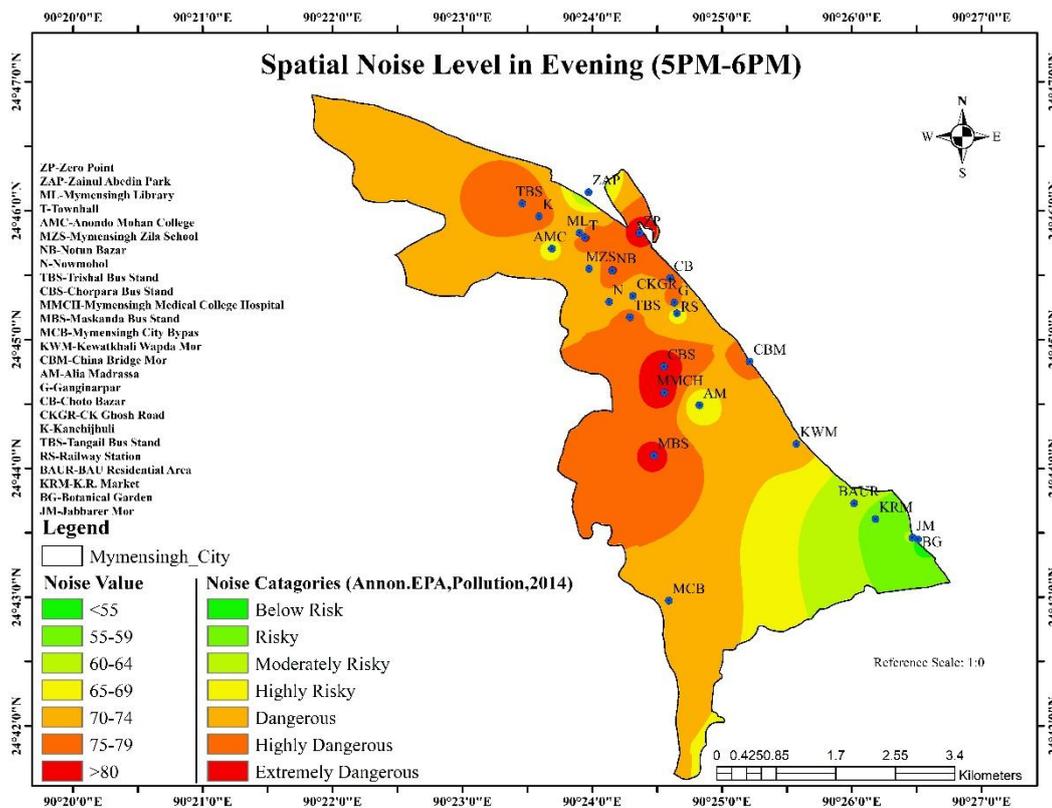


Figure 4. Spatial Noise Mapping in Mymensingh City on evening using IDW.

Figure 4, In evening hours (5 PM-6 PM), the highest noise level (89.5 dB) was found at Charpara Bus Stand and the lowest noise level (49.8 dB) in Botanical Garden.

The obtained Spatial Analytic Maps showed that Mymensingh City's noise level is higher than the guideline values and it is hazardous for human health and the environment. The maps showed the intense noise-affected areas in Mymensingh City.

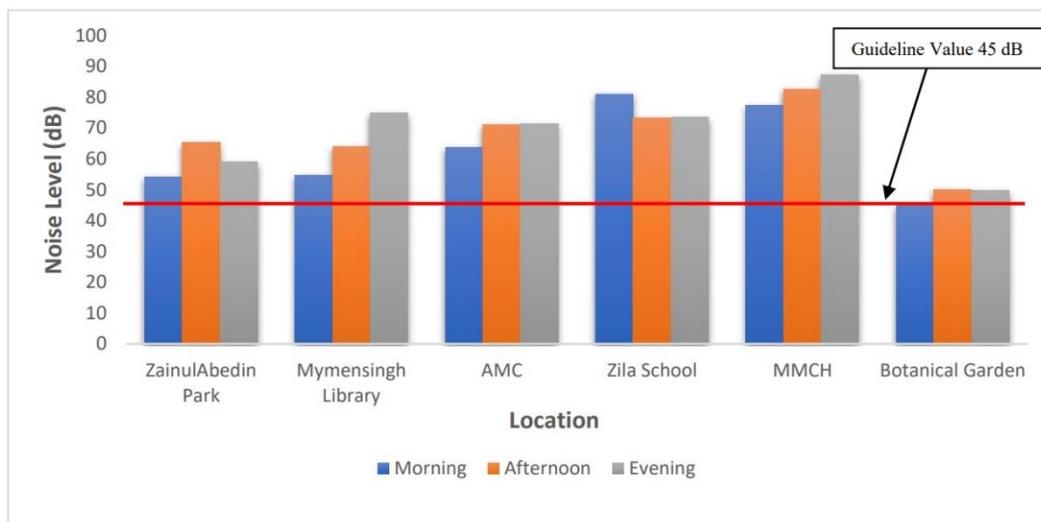


Figure 5. Variation of noise levels with time in Sensitive Areas

Figure 5 shows a variation of noise levels with time at Sensitive or quiet areas of Mymensingh City. The highest noise level was found at MMCH in the evening of about 87.3 dB and the lowest noise level was found at Botanical Garden area in the morning of about 44.9 dB where the guideline value for sensitive areas should not exceed 45dB. Ananda Mohan College and Mymensingh Zila School both are educational institutions with loud sensation of sound level. The highest sound was measured from 80.9dB at morning due to school hours and the lowest was 63.7dB at morning.

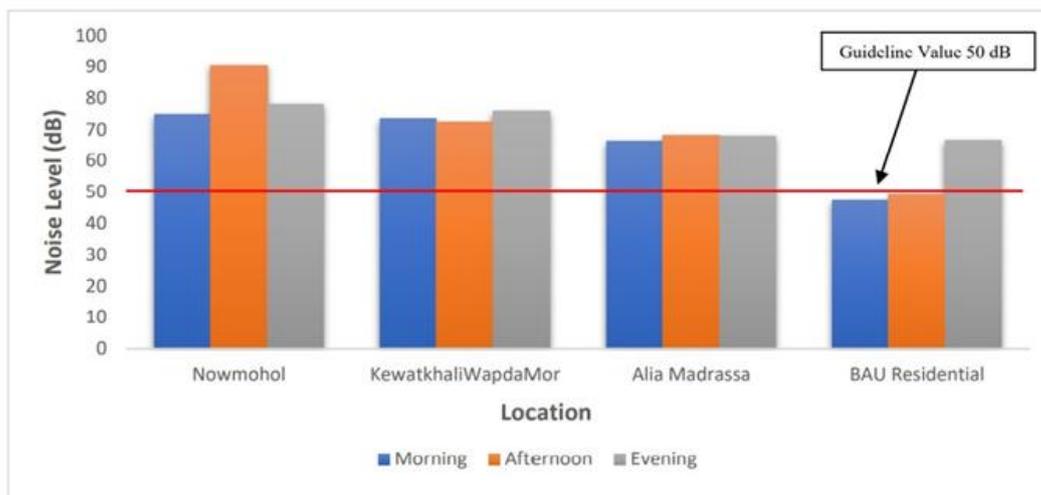


Figure 6. Variations of noise levels with time in Residential areas

Figure 6 shows the variation of noise levels with time at Residential areas of Mymensingh city. The highest noise level was found at Nowmohol in the afternoon of about 90.5 dB. The lowest noise level was found at the BAU Residential area in the morning of about 47.2 dB and the guideline value for residential areas is 50dB. Residential areas were found less noisy on average than other areas in Mymensingh city.

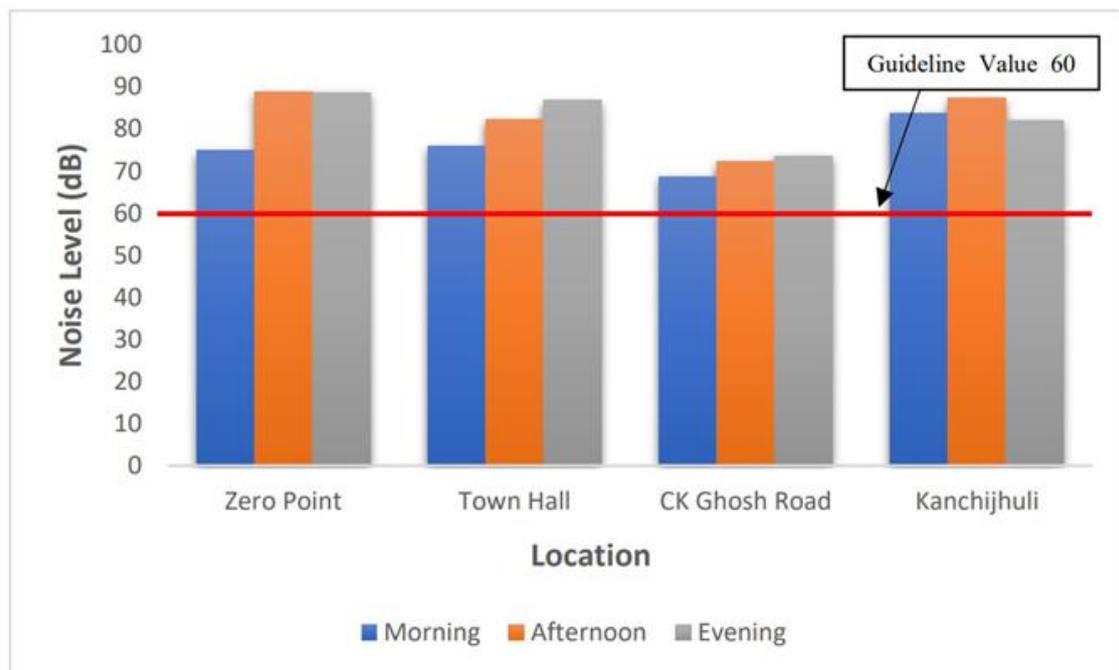


Figure 7. Variations of noise levels with time in Mixed Areas

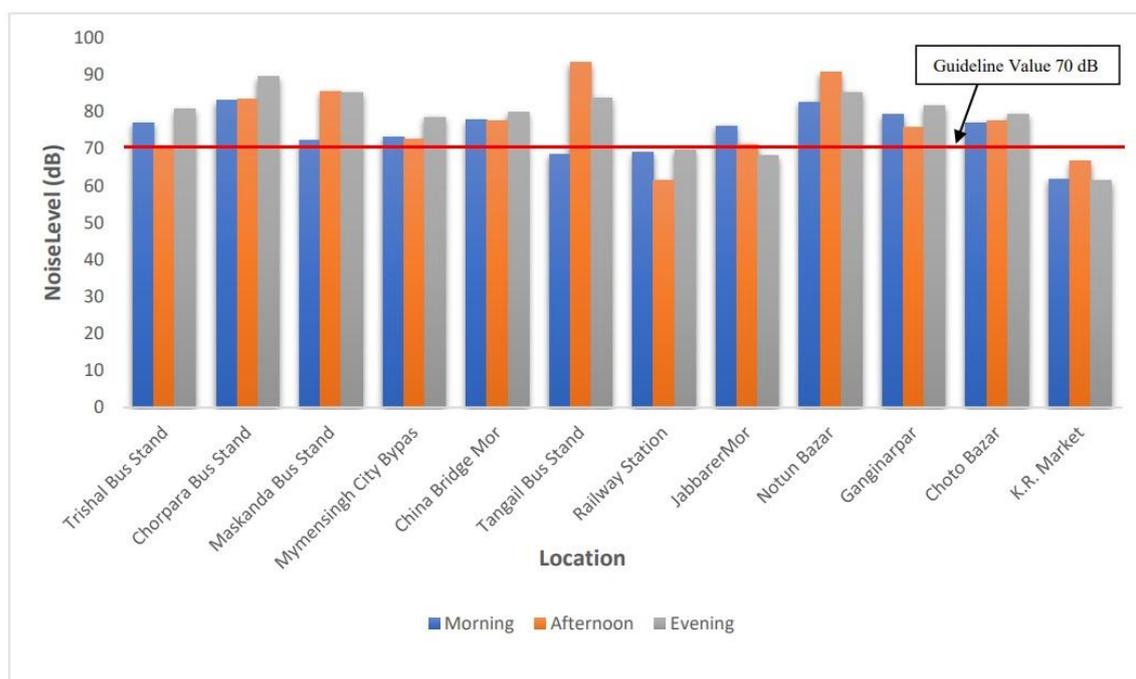


Figure 8. Variations of noise levels with time in Commercial Areas

Figure 7 shows the variation of noise levels with time at mixed areas of Mymensingh city. Mixed areas are those areas that fall in the category of both residential and commercial or industrial areas. The highest noise level was found at Zero Point in the evening of about 88.6 dB. The lowest noise level was found at CK Ghosh Road on the morning of about 68.6 dB where the guideline value is 60 dB.

Figure 8 shows the variations of noise levels with time at Commercial areas of Mymensingh City area. The highest noise level was found at Tangail Bus Stand at afternoon of about 93.3dB. Tangail Bus Stand is also the noisiest place we found in Mymensingh City. The lowest noise level was found at K.R. Market in the evening of about 61.3 dB. All the areas under the commercial zone recorded higher noise levels than the prescribed limit. Trishal Bus Stand, Mymensingh City Bypass, China Bridge More, Ganginarpar, Choto Bazar, CK Ghosh Road, Railway Station, and Jabbarer More hold the loud sensation with the sound levels from 61.3 dB in the afternoon to 79.8 dB in the evening. The higher noise level is due to the human gathering, lots of traffic, horns by buses and trucks, etc.

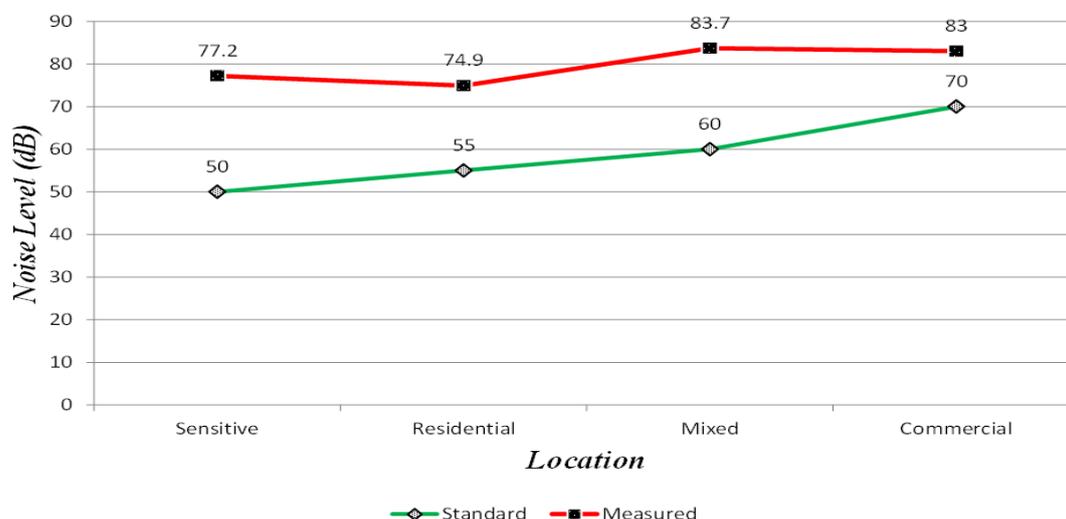


Figure 9. Comparison Between Noise Pollution (Regulation and Control Rules), 2006 and Measured Noise Level

Figure 9 shows a comparison between Noise Pollution (Regulation and Control Rules), 2006, and the Highest Noise Pollution levels in each individual (sensitive, residential, mixed, and commercial) area. It can be seen that the noise pollution levels are far higher than the standard noise level of Bangladesh. So, we can easily say that noise pollution is acute at most places in Mymensingh City.

IV. Noise pollution Effect

After measuring all the data, information, and perspectives, it is evident that sound pollution in Mymensingh city is excessively high from the acceptable noise level provided by WHO and DoE. This high level of pollution affects the environment, human health, and the psychological environment of humans.⁷ Effects of noise pollution level by the areas we studied-

Very Loud: Noise level of Zero Point, Townhall, Notun Bazar, Nowmohol, Charpara Bus Stand, Mymensingh Medical College Hospital-MMCH, Maskanda Bus Stand, Kanchijhuli, Tangail Bus Stand of Mymensingh city are very loud (>75). The noise level remains consistently higher than the acceptable noise level from the morning to the evening. It is unfortunate as well as so alarming that the noise level in MMCH is enlisted here. Both the patients, doctors, and medical students suffer from several problems caused by this severe noise pollution⁹.

Loud: Noise level of Mymensingh Library, Ananda Mohan College, Mymensingh Zilla School, Trishal Bus Stand, Mymensingh City Bypass, Kewatkhali, China Bridge More, Alia Madrasha, Ganginarpar, Coto Bazar, CK Ghosh Road, Railway Station, K.R. Market, Jabbarer More are loud (65> to >75). The locations mentioned above are primarily educational institutions and residential areas. As a result, the people who live here are at a considerable threat to health. Especially the elderly and neonatal people are in danger.

Moderate: The noise level of Zainul Abedin Park, BAU Residential Area, Botanical Garden are intermediate (<60). In this location, the noise level is acceptable in the morning and evening time. The noise level remains a little bit high at noon.

V. Conclusion

The present work is an initial approach towards considering the spatial noise pollution analysis of exposure to ambient noise in Mymensingh city. Several time-specific Noise levels(dB) of various areas of Mymensingh city are measured and analyzed to come to a relevant result and understanding of noise pollution.

The final result shows that the ambient noise levels(dB) of Mymensingh city areas are far higher than the standard noise. The most adverse condition (very loud) is identified in the Charpara (83.0 dB) area, the epicenter of all medical hospitals and diagnostic centers. We observed that the noise pollution level is acute in overpopulated places and remains crowded with traffic and honking horns of various vehicles. This noise level condition is liable for the changing behavior of city dwellers and the cause of severe blood pressure or deafness and other diseases as well.¹⁰ This is high time to impose effective mechanisms to change the acoustic environment needed to alleviate the sound pollution of this city.

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