

Assessment of Noise Pollution in the Natore City Area

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Abstract: Environmental noise is an unwanted and undesirable byproduct of industrialization and urbanization that causes disturbance. Many people struggle to comprehend noise as a physical contaminant. This is because a rise in noise level is difficult to notice because the human ear automatically adjusts to the noise level. Numerous negative consequences, including deafness and mental collapse, may result from rising noise pollution. It is, therefore, necessary to assess the environment where noise levels have risen and analyze it to determine whether a definite disturbance exists. Natore City is one of the old cities of Bangladesh. It is rapidly emerging as an industrialized and urbanized city as it is located near Rajshahi, which is seriously affected by this phenomenon. This study aims to reveal the growing level of noise pollution in Natore City, Bangladesh. During the working days, the noise level measurements were conducted using a digital noise level meter in five different zones from 9 AM to 12 PM. It was seen that the measured noise level of the residential area of six points exceeded the acceptable limits recommended by the DoE. All study points of the educational area crossed the allowable limit. However, eight study points of the commercial area were above the acceptable value recommended by the DoE. The central part of Natore City was less polluted than the eastern and western parts of Natore City. This study also suggests the necessary measures which may be taken to keep the sound level within an acceptable limit.

Keywords: *Noise Pollution, Noise Level Meter, Natore City.*

Introduction: Noise is unavoidable. But people sometimes can't recognize it as a physical contaminant because a rise in noise level is difficult to notice because the human ear automatically adjusts to the noise level [1]. In recent times, noise pollution has been well recognized as one of the significant pollutions that impact the quality of life in urban areas worldwide [2, 3]. Noise pollution is totally different from soil, water and air pollution as its widespread and unique sources which causes adverse health effect in urban and suburban areas [4]. Noise pollution has reached an alarming level in recent years because of the rapid development of industrialization, urbanization, and various communication and transportation networks. Noise pollution is primarily caused by human activity [5]. The city has begun to experience noise pollution issues due to increased population, industrial sectors, transportation, and other man-made activities [6]. With the growth of manufacturing and urbanization in Bangladesh, noise pollution is becoming a serious concern. Noise has a variety of auditory and nonauditory impacts, including hearing loss [7], psychological issues, high blood pressure, abnormal heart rhythms [8, 9], difficulties sleeping, aggravation and tension, and decreased work effectiveness [4]. In experimental sciences, noise can refer to any random fluctuations of data interrupting an expected signal's perception [10]. Noise is becoming an increasingly common and dangerous source of discomfort and hazard due to rising automation, increasingly voluminous and intricate machinery and equipment, and the acceleration of production [11]. It is now widely acknowledged as one of the main concerns affecting the quality of life in urban places worldwide [6]. Noise pollution also affecting wildlife like especially birds as They communicate and defend their territories by using acoustic signals [12]. Noise pollution is a threat to human well-being and fertility. Its seriousness will escalate in the context of dynamically improving the use of more powerful, modified, and transferable noise sources. Noise levels will likewise keep on a ring with supported highway, rail, and air traffic development, the significant wellsprings of environmental noise [13].

Bangladesh is also a growing developing country at risk of noise pollution. The noise level of Dhaka city's residential, commercial, and mixed areas exceeded the Bangladesh standard for sound [14]. Some researchers showed that the noise level in Rajshahi City exceeded the Bangladesh standard for sound [10, 11]. Natore City is one of Bangladesh's old cities, rapidly emerging as an industrialized and urbanized city as it is located near Rajshahi, which is seriously affected by this phenomenon [10]. According to the Bangladesh Bureau of Statistics, in 2011, the population of Natore City was 81,203, now 117800 [15]. The population is growing rapidly, as well as commercial areas and modern vehicles. Sound is natural, whereas noise is man-made. The more population means an increase in noise pollution. However, no data on noise pollution in the Natore city area was found. To tackle future noise pollution, developing and implementing effective measures is vital. An extensive study is required to determine whether the noise level exceeds available limits. To the above discussion, the objectives of the investigation were set as measuring noise levels at different locations of the Natore city area, assessing the noise pollution scenario, and preparing a noise map of noise pollution in the Natore city area.

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Methodology: Natore is a district of the Rajshahi division located in northern Bangladesh. Natore City was established in 1869. Natore City is a part of Natore pourashava. Natore City has an area of 14.80 km². The city has a population of over 117800 residents. There are nine wards and 33 mahallas in Natore City [15]. Natore City is located beside the Narod River. The site selection was made to cover almost all vital road intersections, surrounding local territories, essential institutions, commercial areas, etc., so that the scenario of noise pollution in Natore City could be highlighted. Five zones of the city area were selected. The five zones as shown in Figure 1 and details of each zone are shown in Table 1.

Natore City was divided into five zones. Zone 01- PTI More, Zone 2 - Tebariya Haat, Zone 3 - Railway Station, Zone 4 - Half Rasta More, and Zone 5 - Madrasa More. PTI more (P), the Natore city bypass, the intersecting point where vehicles come from Rajshahi and Dayarampur Road. Tebaria Hat (T) constitutes the major commercial activities in the city. Natore Railway station (R) is an essential point for the railway station, which is one of the most crowded places. Half Rasta More (H) covers important institutes. Madrasa More (M) is the rowdiest place due to the presence of the Bogura bus stand and hospitals. Each zone was divided into three different types of areas. They were residential areas (R), commercial areas (C), and educational areas (E). A total of 30 locations were selected, of which 12 were from residential areas, 12 commercial areas, and six educational areas (Table 2).

The noise level was measured for 3 hours at 15-minute intervals for each sampling location. During the working days, a digital sound level meter (Decibel Meter RZ 1359) was used in the study area from 9 AM to 12 PM. Data collected from the field was processed and analyzed using Microsoft Office Excel 2021. The results were then compared with the acceptable sound levels adopted by [11] for the existing building-up area, as shown in Table 3. Also, ArcGIS Pro was used to analyze the variations and prepare the noise map.



Fig. 1: Selected Study Area at Natore City (Extracted from Google Maps).

Table 1.Coordinates of each selected zone.

Zone No.	Location	latitute	longitute
01	PTI more	24.4039°	88.9848°
02	Tebaria Hat	24.4024°	88.9698°
03	Natore Railway station	24.4109°	88.9665°
04	Half Rasta Mor	24.4131°	88.9778°
05	Madrasa Mor	24.4122°	88.9963°

Table 2.Details of sampling Size.

Zone	Zone Name	Residential Area	Commercial Area	Educational Area	Total
01	PTI More	2	1	2	5
02	Tebaria Hat	3	3	-	6
03	Railway Station	2	2	2	6
04	Half Rasta More	3	2	2	7
05	Madrasa More	2	4	-	6
Total		12	12	6	30

Results and Discussions:

Residential Area: From Fig. 2, it was found that the noisiest residential area was in Madrasa More (MR2), which was 80.1dB, followed by PTI More (PR2) and Tebaria Haat (TR1). The other areas, such as the Railway station residential area (RR) and Half Rasta More residential area (HR), are within the acceptable limit.

Table 3. Acceptable noise level for different areas (Adopted from [11]).

Receiving Land Use Category	Daytime Noise Level (dB)
Residential area	50
Educational area	45
Commercial area	70

In PTI More, the area PR1 was quiet, so the noise level was within the standard limit. On the other hand, PR2, located beside a local road, exceeded the standard limit. In the Tebariya Hat zone, it was found that only TR1 crossed the acceptable limit, which was also beside the local road. All areas exceeded the acceptable limit in the Railway Station and Half Rasta More zones. At Madrasa More Zone, MR1 & MR2 residential area, noise levels have crossed the acceptable limit. It was because these areas were just beside Madrasa More crossing, which was very busy since the highway had crossed here, and there was a bus stand nearby.

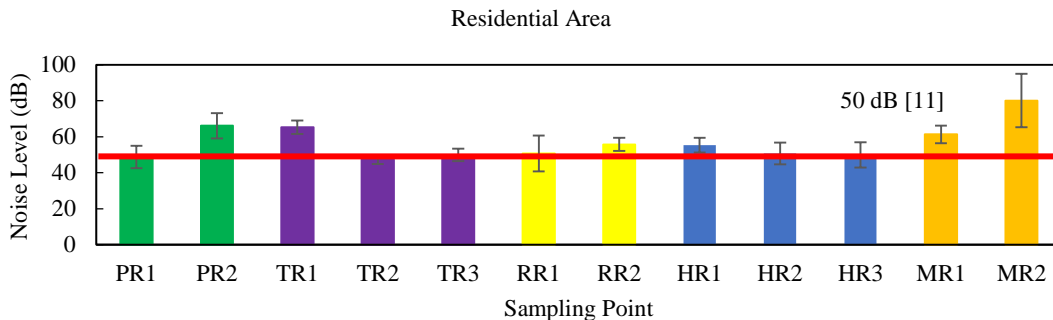


Fig. 2: Noise level in different Residential areas.

Commercial areas: It was found that commercial vehicles such as buses and trucks pass through all the commercial areas of PTI More, the Railway Station area, Half Rasta More, Tebaria Haat, and Madrasa More. Though the maximum permissible limit is 70dB, almost all commercial areas exceed the allowable limits. The maximum noise level was found in the PTI More zone, which was 83.8 dB, as shown in Fig. 3. The noise levels in eight locations have crossed 70 dB, which means these areas are polluted by noise, as the permissible noise limit is 70 dB. It was seen that the most clamorous area is PTI More (PC1) and Natore Railway Station (RC1). Tebaria Haat (TC1, TC3) and Madrasa More (MC1) are the other noisy places. They are in great danger of noise pollution, and at TC2, the lowest value was measured (53.3 dB).

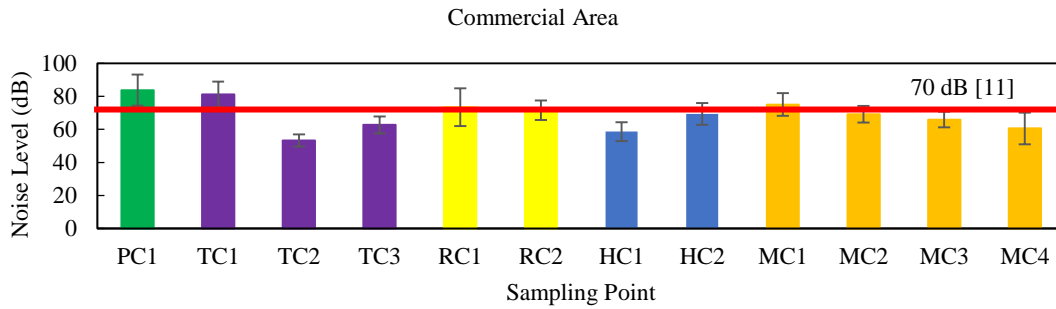


Fig.3: Noise level in different Commercial areas.

Educational areas: The observed noise levels are shown in Fig. 4. The reason for high noise pollution in educational institutions was that the location of the institutions was either beside busy streets or in busy areas. However, they all cross the permissible value and are in danger of noise pollution.

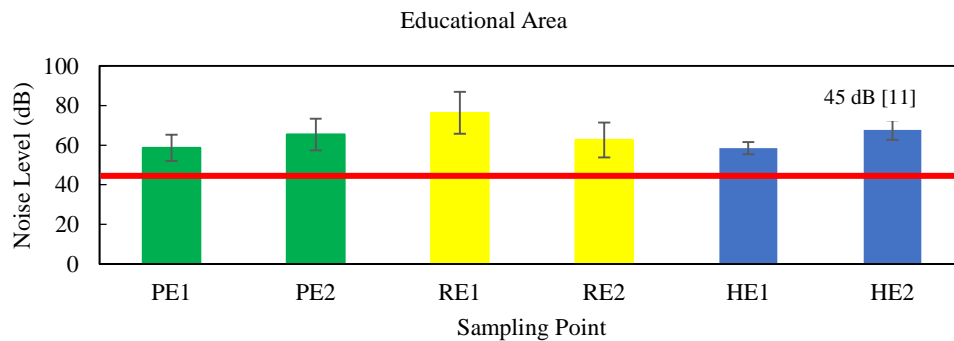


Fig. 4: Noise level in different educational areas.

The maximum noise levels at selected study points were determined from the above data analysis. The highest noise was found to be 83.8 dB at PTI More commercial area, and the lowest was found to be 47.2 at Tebaria Haat residential area. This study found that two points exceeded 100 dB, and eight crossed 90 dB, nearly 100 dB. On the other hand, in the surrounding city, from the study of Rajshahi City, Maximum noise levels at the ten survey points were determined to be between 93 and 105 dB. Analysis revealed that all locations exceeded the maximum acceptable noise limit. Bhodra More, Railway Station, Talaimari More, Rail Gate, and Kashiyadanga are the most affected zones of noise pollution in Rajshahi City [11].

Noise map: A noise map of Natore city considering noise level was prepared, as shown in Fig. 5. The map was categorized into five zones based on noise levels (Fig. 5). Four points are within the first zone (40-50 dB), and eight are within the second zone (50-60 dB). The third zone (60-70dB) has eleven points and four points within the fourth zone (70-80dB). There are three points in the last zone (80-90dB). The noise map (Figure 5) shows that the eastern part of Natore City is noisy and highly affected by noise pollution (70-80dB). This area is Madrasa More, which is considered the busiest place in Natore City and has a number of private clinics and diagnostic centers. This noise pollution may harm patient health and staff well-being because it impairs the overall quality of care [16, 17, 18]). Next, Natore Railway Station is also a bustling area in the western part of Natore city. The central part of Natore City is less polluted by noise pollution. This study found that twenty-two points had noise levels above the acceptable limit of thirty points, which may cause sleeplessness, hypertension, cardiovascular diseases, blood pressure [8, 19], deafness [20] mental illnesses [21] and loss of memory [22].

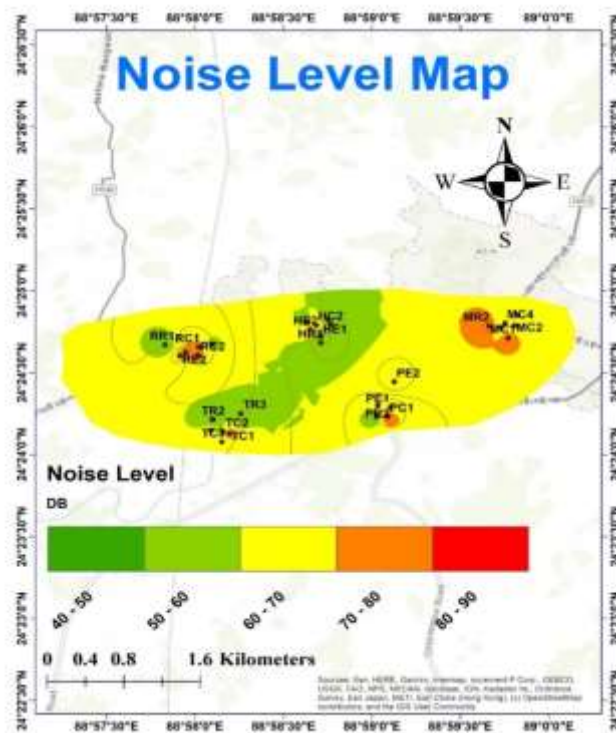


Fig. 5: Interpolation of noise level of Natore City.

Conclusion and Recommendation: This research studied the noise level in Natore City using the noise level meter. All findings are summarized below:

- Five different locations were selected to measure the noise level. They are PTI More, Tebariya Haat, Railway Station, Haaf Rasta More, and Madrasa More.
- Out of thirty study points, only eight points are within the acceptable limit. So this means the noise level in Natore City is growing rapidly.
- According to the noise map, the city's center part is less polluted by noise than the eastern and western parts.

It can be concluded that noise should be considered a primary environmental concern as the noise pollution measured in some locations has reached levels very high. There should be public awareness of the dangers posed by noise pollution.

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