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Assessment of noise pollution in Rajshahi city and remediation

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Abstract

This research article reports on a study conducted on 2022 and 2023 to measure noise levels at five selected locations in Rajshahi, Bangladesh. During the study, selected noise locations NQ1 and NQ4 fell under the silent zone, NQ2 and NQ5 fell under the commercial zone, and NQ3 fell under the industrial zone followed by the regulations of Bangladesh. The maximum allowable noise level of Bangladesh at day time are 50 dB(A) in the silent zone, 70 dB(A) in the commercial zone, and 75 dB(A) in the industrial zone. The study found that noise levels at NQ1 and NQ4 exceeded the Bangladesh standard by almost 75%, while noise levels at NQ2 and NQ5 were around 25% higher than the standard. The study also measured the noise levels of auto-rickshaws using TT Horn and Plastic Air Horn and found that the noise level for the Plastic Air Horn was within the limit, but it was exceeded for the TT Horn. The study highlights the need for regulations to control noise pollution in Bangladesh and suggests possible interventions to reduce noise levels from auto-rickshaws.

Keywords: Noise Pollution; Auto-rikshaw; Rajshahi Noise Pollution; Sustainable Development

1. Introduction

Noise pollution, defined as the presence of excessive and unwanted sound in the environment, has become an environmental issue that increasing globally has become a significant concern for the public health sector. The World Health Organization (WHO, 2021) reported that about 1.1 billion young people worldwide are at risk of hearing loss due to prolonged exposure to high sound levels. Philimoni, et al. in 2011 and Crmiel, et al. in 2004 stated noise pollution as the increased level of noise to an irritable level. Amurtha et al. in 2016 and Mahmud and Alsubaie in 2016 stated that noise pollution and its effect on human health has been of great concern and is recently considered a vital issue. Specially it is a major concern in developing countries. According to Frontiers 2022: Noise, Blazes and Mismatches report of United Nations Environment Programme, Dhaka world's noisiest city, Rajshahi was 4th on list. Martin, et al. in 2006 described noise pollutions one of the key problems of urban communities that has numerous hazardous effects on the urban environment and may result in a great deal of costs on the society. According to S.R.O. 212-law/2006 on noise pollution Bangladesh, maximum permitted noise level has been divided in to five zones; silent zone, residential zone, mixed zone, commercial zone and industrial zone. World Health Organization (WHO) described the levels of noise seriously harming human health and activity. Mandal, S.et al. in 2017 stated that, transportation sector and power generation sector are the largest consumer of fossil fuel.

According to a study conducted by the Department of Environment of Bangladesh, noise pollution in the country's urban areas has exceeded the permissible limit set by the government, with the city of Dhaka being the most affected (DAE, 2016). This environmental concern has been particularly relevant in developing countries, where rapid industrialization and urbanization have caused a massive increase in sound pollution. Bangladesh, as one of the developing countries, has been facing a significant increase in sound pollution, particularly in its urban areas, including the city of Rajshahi. However, despite the known adverse effects of sound pollution, there is a paucity of research on

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sound pollution in Bangladesh, particularly in the city of Rajshahi. In recent years, there has been a significant increase in the use of battery-operated vehicles in the transportation sector in Rajshahi city, Bangladesh. Specifically, the use of battery-operated auto-rickshaws has become increasingly popular as a means of transport.

Battery-operated vehicles are often touted as a more environmentally-friendly mode of transportation, they may still contribute to sound pollution. In Rajshahi city, the increasing use of battery-operated auto-rickshaws has raised concerns about their potential to generate high levels of noise, which can have adverse effects on public health and quality of life. A study published in the International Journal of Engineering and Advanced Technology found that battery-operated auto-rickshaws produced noise levels of up to 90 dB(A), which is well above the World Health Organization's recommended limit of 70 dB(A) for urban areas (Mondal et al., 2018). The study recommended that measures be taken to reduce noise pollution from battery-operated vehicles to mitigate their impact on public health and the environment. Therefore, this study by Barendra Poribesh Unnayan Sechchasheby Sanghstha also aims to investigate the levels of sound pollution of these auto-rickshaws in the Rajshahi city of Bangladesh.

Objective of the study

The core focus of the study by Barendra Poribesh Unnayan Sechchasheby Sanghstha, more specifically, is based on the measurement of Noise Level in Rajshahi City Corporation. In this regard, objective of this research are-

- To assess the noise level.
- To recommend remediation.
- To summarize present knowledge, knowledge gaps and directions for future research.

The study can lead towards mitigation measure to control excessive noise level in Rajshahi City Corporation.

2. Material and methods

The aim of this study was to measure the noise levels from selected locations in Rajshahi city and to investigate the potential impact of battery-operated auto-rickshaws on sound pollution. In order to achieve this, a literature review was conducted to compile reliable information on noise quality in urban areas. The analyses were carried out using a TASi TA8151 - Class 2 digital sound level meter, which is a widely accepted device for measuring sound levels in environmental studies. The study was conducted within the area of Rajshahi City Corporation, which is one of the largest and most populous cities in Bangladesh.

To measure the noise levels, five sampling locations were selected and marked on the map, figure 1. These locations were NQ1, NQ2, NQ3, NQ4, and NQ5, and their GPS coordinates were recorded, shown in table 1. The noise level was measured at each location for a period of 30 minutes, and the average value was calculated. This was done to ensure that the noise levels were measured accurately and that the readings were representative of the noise levels in each location.

Table 1 Selected Noise Measurement Locations with GPS Coordinates

SN	Sampling Locations ID	Name of the Location	GPS Coordinates of Sampling Locations	
1	NQ 1	Talaimari	24°21'42.35"N	88°37'37.41"E
2	NQ 2	Railgate	24°22'28.76"N	88°36'15.14"E
3	NQ 3	BSCIC	24°23'15.97"N	88°36'12.41"E
4	NQ 4	Laxmipur	24°22'18.83"N	88°34'57.03"E
5	NQ 5	Zero Point Shaheb Bazar	24°21'55.20"N	88°36'0.58"E

In addition to measuring the noise levels at the sampling locations, the noise levels of the TT Horn and Plastic Air Horn of an auto-rickshaw were also measured. This was done at a distance of 0.5m (45^0 angle from source), 7.5m, 10.0m, and 20.0m to understand the intensity of both horns. The aim of this was to investigate the impact of battery-operated auto-rickshaws on sound pollution and to identify whether the use of these vehicles contributed to high noise levels in urban areas. This research methodology aimed to measure the noise levels in selected locations in Rajshahi city and to investigate the impact of battery-operated auto-rickshaws on sound pollution. The use of a sound level meter and the

selection of multiple sampling locations ensured that the data collected was reliable and representative of the noise levels in the study area.

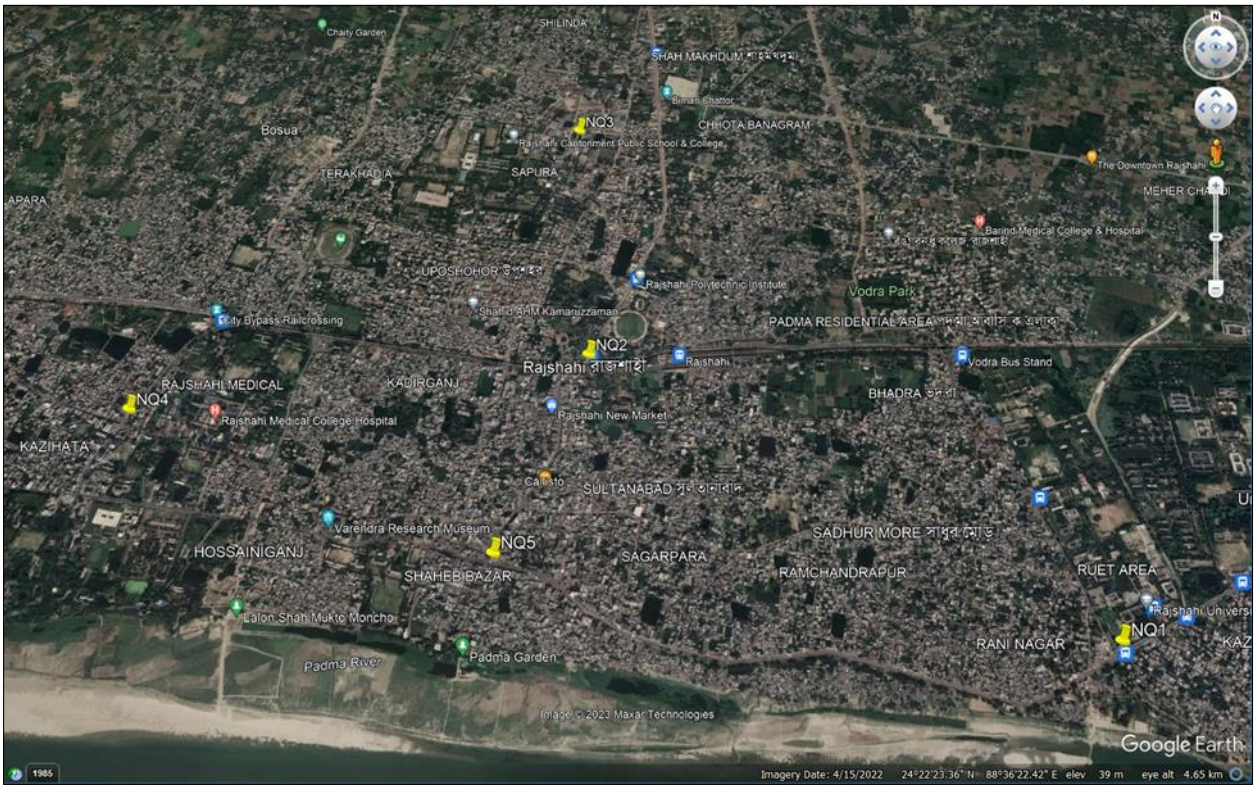

Figure 1 Noise Level Sampling Locations

3. Results and discussion

According to the study conducted on April 21, 2022, noise levels were measured at five different locations, namely NQ1 to NQ5, during the day. These locations were again measured at different times over the next year. NQ1 was within 100m of Rajshahi University of Engineering and Technology, NQ2 was in a busy area with several markets and shops, NQ3 was located within BSCIC area, there were several private hospitals within 100m of NQ4 and NQ5 was also in a busy area with markets and shops. The study found that NQ1 and NQ4 fell under the silent zone, NQ2 and NQ5 fell under the commercial zone, and NQ3 fell under the industrial zone, according to the noise zones prescribed by Bangladesh regulations. The maximum noise levels during the day were 50 dB(A) in the silent zone, 70 dB(A) in the commercial zone, and 75 dB(A) in the industrial zone.

Average noise level at five selected locations are shown in below figure 2.

The study found that noise levels at NQ1 and NQ4, which fell under the silent zone, were almost 75% higher than the Bangladesh standard during the day, while noise levels at NQ2 and NQ5, which fell under the commercial zone, were around 25% higher than the Bangladesh standard during the day. However, the noise level at NQ3, which fell under the industrial zone, was within the Bangladesh standard at day time.

It was observed from the study that, noise level at silent zone, NQ1 and NQ4 location were almost 75% higher than Bangladesh standard at day time. Noise level at commercial zone, NQ2 and NQ4 were around 25% higher than Bangladesh standard at day time. But noise level at industrial zone, NQ3 was within Bangladesh standard at day time. Gathering of huge number of auto-rickshaw was observed at NQ2, NQ4 and NQ5 locations during these measurements. It can be noted that, most of those auto-rickshaw in Rajshahi city are using TT Horn and few of them using Plastic Air Horn.

During the study period, a large number of auto-rickshaws were observed at NQ2, NQ4, and NQ5 locations, and it was noted that most of them were using TT Horn, while a few were using Plastic Air Horn. Reference to the information's of

Rajshahi City Corporation, there were approximate 6,000 Auto (five passenger seater) and 10,000 Auto Rickshaw (two passenger seater) at Rajshahi city in 2022. To investigate the noise levels of auto-rickshaws, the noise level of a rickshaw was measured at a place without any additional noise, and the noise level was around 42 dB(A) during the study period. The noise level of the TT Horn and the Plastic Air Horn was measured at a distance of 0.5m and 7.5m, following the guidelines of S.R.O. 212-law/2006, as well as at a distance of 10m and 20m. The maximum noise level at a distance of 0.5m from the source should be 100 dB(A) at a measurement angle of 450 from the source, according to the guidelines, and the maximum noise level at a distance of 7.5m should be 85 dB(A), straight from the source. The study found that the noise level for the Plastic Air Horn was within the limit, but it was exceeded for the TT Horn. It was also observed that the noise level decreased significantly with distance for the Plastic Air Horn, but there was an insignificant change for the TT Horn. The results and photos of the auto-rickshaw are shown in figure 3 and figure 4, respectively. Similar findings was reported when study was conducted in India in 2016, where noise levels were measured at different locations in Chennai. The study found that traffic noise levels were higher than the prescribed limit in many areas of Chennai, and auto-rickshaws were identified as one of the primary sources of noise pollution (Venkatraman & Balakrishnan, 2016). Another study was also found similar findings which was conducted in 2015 in Tehran, Iran, found that traffic noise levels were higher than the World Health Organization (WHO) recommended limits, and auto-rickshaws were identified as one of the major sources of noise pollution (Gohari et al, 2015).

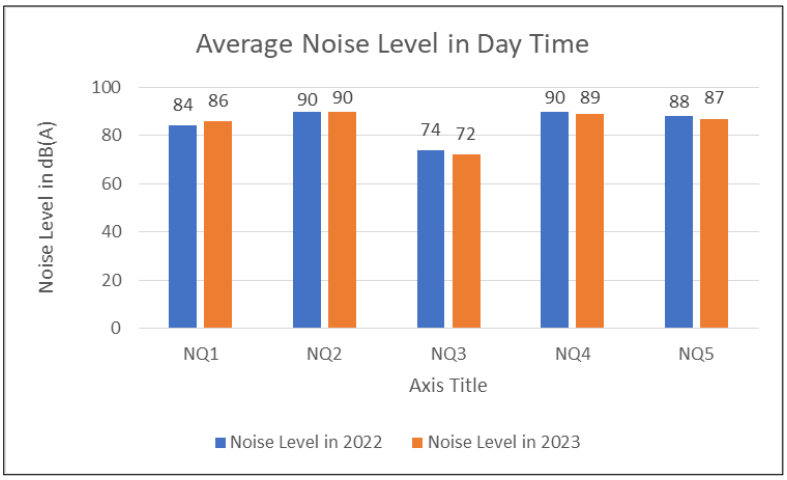

Figure 2 Noise Level at Five Selected Locations

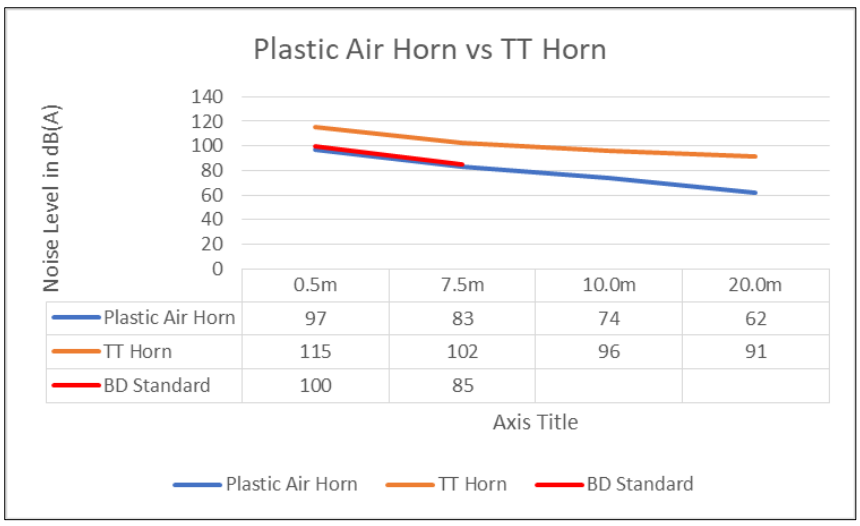

Figure 3 Noise Level of Plastic Air Horn and TT Horn

Considering the huge amount of auto-rickshaw in Rajshahi city, we also measured noise level from an auto-rickshaw using TT Horn and Plastic Air Horn. We brought the rickshaw to a place without extra/additional noise. During study

period, noise level of that area was around 42 dB(A). Then we measured noise level from TT Horn and Plastic Air Horn at a distance of 0.5m and 7.5m followed by the guideline of S.R.O. 212-law/2006. We also measured noise level at a distance of 10.0m and 20.0m. Details results are shown in below figure 3.

According to S.R.O. 212-law/2006 of Bangladesh, maximum noise level at 0.5m distance will be 100 dB(A) at a measurement angle of 45^0 from the source. And maximum noise level at 7.5m distance will be 85 dB(A), straight from the source. Noise level for Plastic Air Horn was within the limit but it was exceeded for TT Horn. It was also observed that, noise level at 10.0m and 20.0m distance for Plastic Air Horn were 74 dB(A) and 62 dB(A) whether it was 96 dB(A) and 91 dB(A) for TT Horn. Noise level of Plastic Air Horn significantly decreased with distance but it was insignificant change for TT Horn. Details photos of that auto-rickshaw is shown in below figure 4.

Auto-rickshaw Plastic Air Horn TT Horn

Figure 4 Auto-rickshaw

4. Conclusion

The city of Rajshahi in South Asia is known for its cleanliness and beauty. However, with the increasing urbanization and population growth, the number of auto-rickshaws as a local transport option has also increased. This has resulted in an increase in noise pollution, which can lead to critical health issues such as heart attacks and hearing problems. Children are especially vulnerable to the effects of noise pollution, and it also affects animals and birds. Therefore, it is essential to control unnecessary horn usage of auto-rickshaws and other vehicles strictly. To address this issue, there is a need to increase public awareness of the harmful effects of noise pollution and the importance of reducing it. By taking appropriate measures to control noise pollution, Rajshahi city can continue to be a beautiful and healthy place to live in.

Compliance with ethical standards

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Disclosure of conflict of interest

All authors declare that they have no conflicts of interest.

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