

TRAFFIC INDUCED NOISE LEVEL IN DIFFERENT PLACES AT THE DHAKA CAPITAL CITY OF BANGLADESH

M. M. M. Hoque*, M. A. Islam and M. H. Kabir

Department of Environmental Science and Resource Management
Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh

*Corresponding author's email: huqmbstu@gmail.com

ABSTRACT

The study was conducted to appraise the noise levels at eight different commercial as well as heavy traffic areas (St-1, St-2, St-3, St-4, St-5, St-6, St-7, St-8) of the Dhaka capital city during the period from January to April, 2017. Time-weighted average noise levels were measured using Multi-Function Environmental Meter (Model: ST-8820). The results of the study found that average noise levels at day time (8:00 AM to 12:00 PM and 2:00 PM to 6:00 PM) were 78.1, 79.5, 76.2, 76.8, 75.0, 76.3, 80.5 and 79.6 dB in St-1 to St-8, respectively. On the other hand, the values were 82.4, 85.5, 78.3, 80.2, 79.7, 81, 86.5 and 85.6 dB for night time (6:00 PM to 9:00 PM), respectively. All of the recorded noise levels exceeded the DoE standard for noise level of commercial area. The study also found that noise levels on weekend were comparatively less than the working day due to low traffic congestions in the study areas. However, noise levels were higher at night than day time might be due to huge number of vehicles at evening time. Moreover, relative humidity, temperature and number of vehicles were measured both on weekend and working day to correlate with noise level, where the study revealed positive relationship between relative humidity and noise levels and negative relationship between temperature and noise level. The actual sources of noise pollution in Dhaka city were identified as: police and ambulance sirens, car horns, heavy traffic, stationary and mobile sound system, places of prayers, public meetings, motor bikes, mobile loud speakers, vehicle repair workshops, construction work, factories, loud voices, planes etc. The results of the study reveals that the noise pollution level in the Dhaka city will become more hazardous the day to come. Considering the stated issues of noise pollution, study recommend the banning on hydraulic horns, improvement of traffic carrying capacity on roads, training for drivers and regular monitoring of noise level to control of noise pollution at Dhaka city.

Key words: Noise pollution, traffic, weekend day, working day, Dhaka city.

Introduction

All over the world noise pollution is recognized as a significant prime environmental problem for healthy life especially in urban areas (Nadir *et al.*, 2018). The level of sound that exceeds permissible level and creates annoyance, hampers mental peace and may cause damage to the health is called noise pollution (Nunez *et al.*, 1998). The main sources of noise pollution of the town include transport system, industries, construction activities, market, sound system and advertisement (Rouf and Jahan, 2007; Mollah, 2010; Belojevic *et al.*, 2012). Worldwide it is recognized as occupational hazard and exposure to high levels of noise creates hearing problem called NIHL or noise induced hearing loss (NIOSH, 1998), which attributes on hypertension, aggression, sleep disturbance and finally reduces work performance, efficiency (Husain *et al.*, 2015). In Bangladesh, noise pollution poses a major threat for people, especially in city dwellers of Dhaka. According to a recent study conducted by WHO (2010) at 45 locations of Dhaka city, most of the traffic points and many of the industrial, residential, commercial, silent and mixed areas are suffering noises exceeding the standard limits of Bangladesh. The root cause of this noise pollution in mega city as well as Dhaka city is its traffic congestion (Gershone *et al.*, 2006). Most of the motor vehicles such as buses, mini-buses and trucks use hydraulic horns continuously until their ways become free (Mukherjee *et al.*, 2003). Besides reckless driving by the drivers, overtaking and lack of knowledge creates noise pollution. However, noise pollution is harmful to human health, children mental development, willingness to work and study etc. According to BAPA (2000) about 5-7 % of the patients admitted to the BSMMU (Bangladesh Sheikh Mujibur Rahman Medical University) Dhaka, suffered from deafness due to severe

noise pollution. Considering noise pollution as an alarming issue present study was designed to determine the status of noise level in Dhaka city both on working day and weekend day with day-night variation to be ensured the noise pollution free capital city of Bangladesh.

Materials and Methods

Study area: A total of eight commercial and heavy traffic areas namely such as Abdullahpur (St-1), Mohakhali (St-2), Gabtoli (St-3), Shamoli (St-4), Farmgate (St-5), Motijheel (St-6), Gulistan (St-7) and Saidabad (St-8) (Fig. 1) of Dhaka City Corporation were selected for being conducted the study. The area of Dhaka is about 1497.17 sq.km and has a population estimated about 8.5 million. It is considered as most densely populated city in the world, and the density is 23,234 people/sq.km (Chowdhury *et al.*, 2010).

Instrument used in the study: A multi-function environmental meter (Model: ST-8820) was used for measuring noise levels. It consists of a microphone that converts noise pressure fluctuations into a same pattern of electronic voltage. The sound level in dB is defined as follows:

$$\text{Sound level (dB)} = 10 \log_{10} \left(\frac{p}{p^0} \right)^2$$

$$= 20 \log_{10} \left(\frac{p}{p^0} \right)$$

Where, p= Root-mean square of sound pressure

p⁰= Standard reference pressure corresponding to the weakest audible sound (20 micro Newton) per sq.m

Data collection: Noise levels at eight points of Dhaka City Corporation were measured in weekend and working days for the period of January to April, 2017. The measurement of noise levels were carried out into two main time period such as: (i) Day Hours (8:00 AM to 12:00 PM and 2:00 PM to 6:00 PM), and (ii) Night Hours (6:00 PM to 9:00 PM). The sound level meter was situated approximately 1.5 meter above the ground level. During each hourly interval sound pressure level, relative humidity and temperature were measured for a period of one minute (three times).

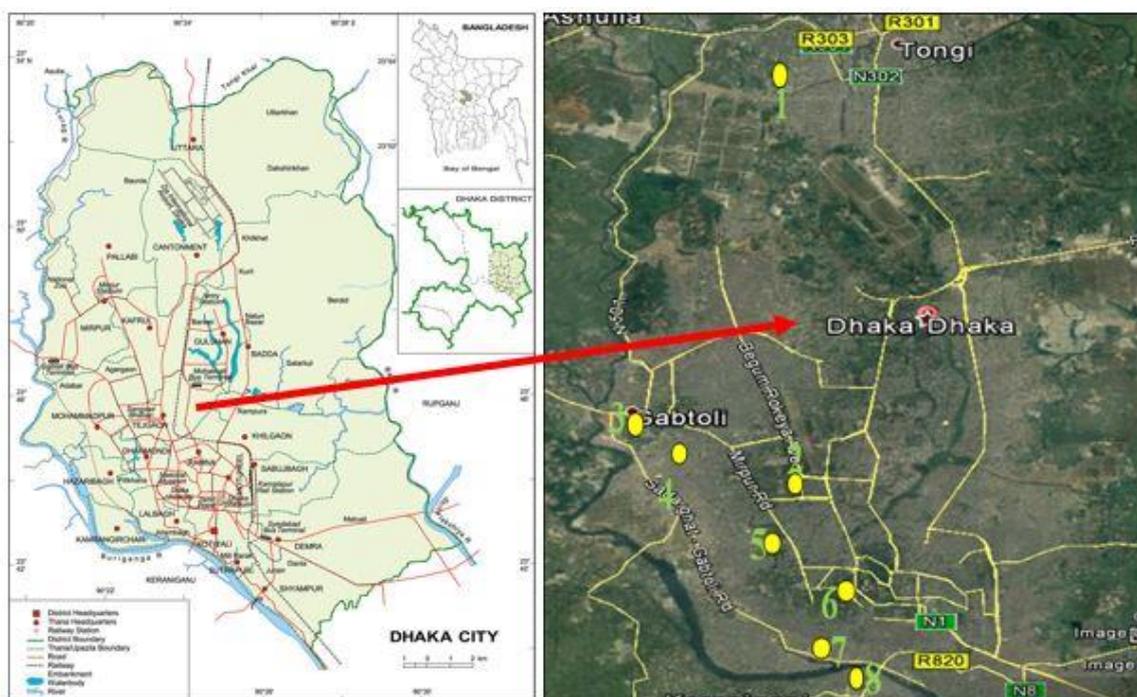


Fig. 1. Map showing the study area of the Dhaka capital city

Data analysis: The collected data were processed, analyzed and interpreted for final presentation with the help of statistical techniques and equation with percentage and graphs. Because of logarithmic nature of the dB, the average value of a collection of sound pressure level measurements in the normal fashion, instead the following equation was used (Davis and Cornwell, 1998).

$$L_p = 20 \log 1/N \sum_{j=1}^N 10^{(\frac{L_j}{20})}$$

Where, L_p = average sound pressure level, dB re: 20 μ pa

N = number of measurement

L_j = the j^{th} sound pressure level, dB re: 20 μ pa

$j = 1, 2, 3, \dots, N$

Results and Discussion

Noise levels in working day: In working day, average day time noise levels were ranged from 75.99 to 81.5dB, whereas 80.5 to 88.5dB for night time (Table 1). Present study revealed that during day time average noise level was highest in Gulistan at 5-6 pm. During night time, average highest noise (93.2dB) was also recorded in Gulistan at 6-7pm. According to DoE (2006), in both cases noise level exceeded the acceptable (70 dB and 60dB at day and night time, respectively) limits for commercial areas. Peoples move towards their working places such as offices, court, and industry, again students move towards school, colleges and university by using vehicles during working day. These are the main reasons of excessive noise level in working day in Dhaka city. Husain *et al.* (2015) found that noise level in working day at Gabtoli, Shamoli, Farmgate, and Gulistan were 75.3, 75.7, 76.9 and 73.1dB which were similar to our day time working days.

Noise levels in weekend day: In weekend day, average day time noise levels of the study locations were ranged between 75.1 to 79.4dB and average noise level at night time were ranged from 78.9 to 84.6 dB (Table 2) which far exceeded the acceptable limit of noise level set by the DoE (ECR, 1997). A study conducted by World Health Organization on noise pollution of Dhaka city found noise level of 70 dB in Farmgate, and 73 dB in Motijheel (WHO, 2010). Another study was conducted by Husain *et al.* (2015) on noise pollution of Dhaka city and found noise level as 63.3, 64.9 and 70.2 dB in weekend day at Farmgate, Gabtoli and Gulistan, respectively. The measured existing noise levels are higher than previous study which implies environmental noise level in Dhaka city is increasing day by day.

Table 1. Status of noise level at different locations in working day

Locations	Noise level (8 am – 6 pm)			Noise level (6 pm – 9 pm)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Abdullahpur (St-1)	84.4 (5-6 pm)	73.7 (8-9 am)	80.1	85 (7-8pm)	82 (8-9 pm)	83.6
Mohakhali (St-2)	87.2 (5-6 pm)	75.9 (8-9 am)	80.8	88.6 (8-9pm)	86.4 (7-8 pm)	87.8
Gabtoli (St-3)	80.7 (10-11pm)	73.1 (2-3 pm)	77.3	83 (7-8pm)	79 (8-9 pm)	80.6
Shamoli (St-4)	82.4 (4-5 pm)	73.5 (8-9 am)	77.6	82.8 (6-7pm)	78.6 (8-9 pm)	80.6
Farmgate (St-5)	81 (4-5 pm)	69.4 (8-9 am)	75.9	82.4 (6-7pm)	79.2 (8-9 pm)	80.51
Motijheel (St-6)	81.4 (5-6 pm)	72.5 (8-9 am)	78.1	84 (6-7pm)	80.2 (8-9 pm)	82.1
Gulistan (St-7)	88.6 (5-6 pm)	75.9 (8-9 am)	81.49	93.2 (6-7pm)	84.6 (8-9 pm)	88.54
Saidabad (St-8)	83.8 (5-6 pm)	74.6 (8-9 am)	80.90	91.7 (6-7pm)	81.3 (8-9 pm)	86.61

Table 2. Status of noise level at different locations in weekend day

Locations	Noise level (8 am – 6 pm)			Noise level (6 pm – 9 pm)		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Abdullahpur (St-1)	79.4 (2-3 pm)	69.7 (8-9 am)	76.1	83.1 (6-7 pm)	79.1 (8-9 pm)	81.1
Mohakhali (St-2)	82.7 (5-6 pm)	72 (8-9 am)	78.2	84.9 (6-7 pm)	81.7 (8-9 pm)	83.2
Gabtoli (St-3)	77.9 (5-6 pm)	70.7 (8-9 am)	75.1	77.7 (6-7 pm)	74 (8-9 pm)	76.06
Shamoli (St-4)	78.4 (5-6 pm)	73.1 (8-9 am)	75.9	81.1 (6-7 pm)	77.3 (8-9 pm)	79.6
Farmgate (St-5)	80.3 (5-6 pm)	68.8 (8-9 am)	73.9	81.5 (6-7 pm)	76.2 (8-9 pm)	78.9
Motijheel (St-6)	78 (5-6 pm)	69.4 (8-9 am)	74.4	81.3 (6-7 pm)	77.9 (8-9 pm)	80.01
Gulistan (St-7)	85.5 (5-6 pm)	68 (8-9 am)	79.4	86.6 (6-7 pm)	80.3 (8-9 pm)	84.49
Saidabad (St-8)	84 (5-6 pm)	70.1 (8-9 am)	78.3	88.9 (6-7 pm)	80.4 (8-9 pm)	84.6

Day-night variation of noise level at selected areas in Dhaka city: The reasons of high noise level at night were due to huge number of vehicles and people crowding. Highest noise level variations were found at Mohakhali, Gulistan and Saidabad (Fig. 2). In these locations, traffic congestions were higher than the day time. Lowest day-night noise variation was found at Gabtoli.

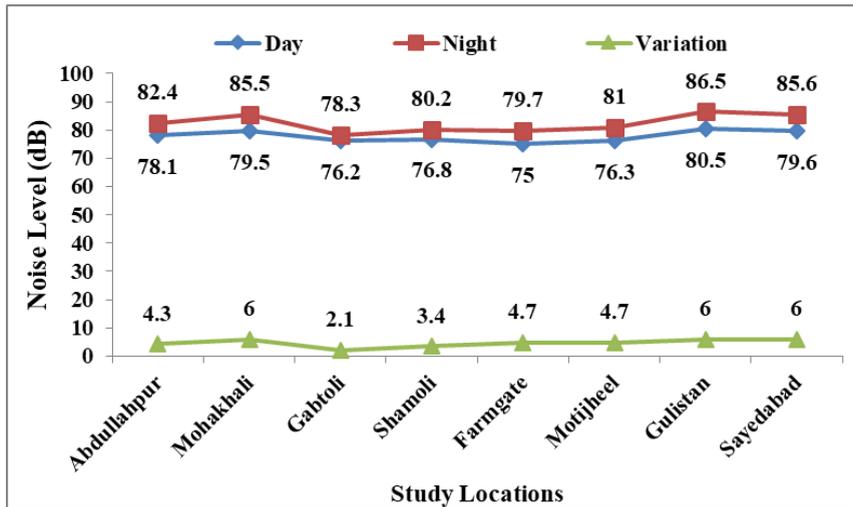


Fig. 2: Day-night variation of noise level at selected areas in Dhaka city

Correlation matrix among noise level, vehicle number, relative humidity and air temperature: Correlation matrix among noise level, vehicle number, relative humidity and air temperature was determined by Karl Pearson’s correlation along with significant level (Fig. 3).

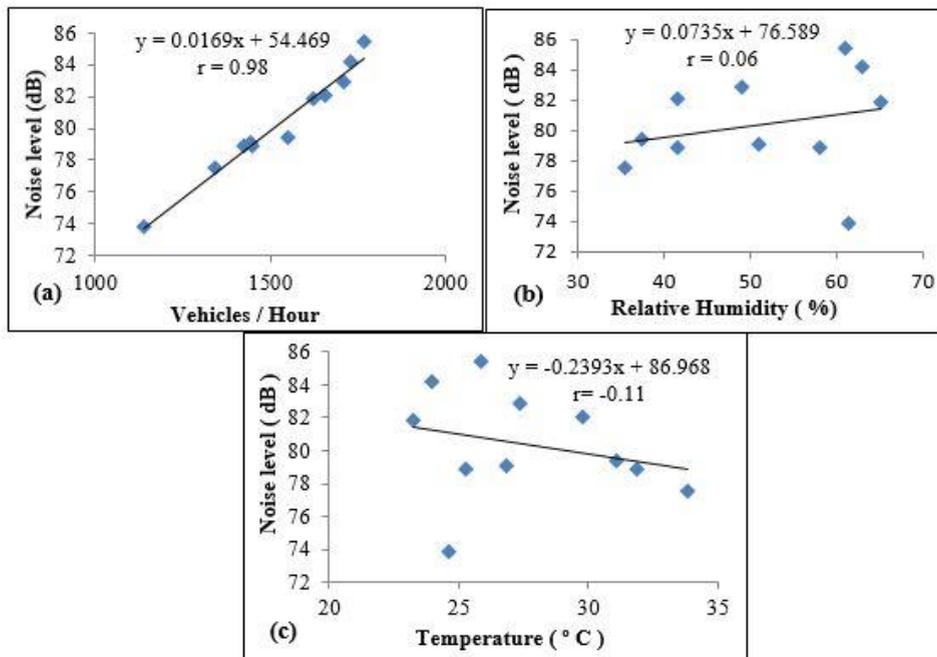


Fig. 3: Regression line between number noise level and number of vehicles (a), noise level and relative humidity (b) and noise level temperature (c).

Noise level had a significant positive ($r=0.98$; $p<0.01$) relation with vehicle numbers. Conceptually, there is a positive relation between relative humidity and noise level again negative relation between air temperature and noise level. But correlation coefficient did not show any strong relation. There were found positive relation between noise level and relative humidity ($r=0.06$) and negative relation between noise level and temperature ($r=-0.11$). Based on the relationship of noise level with other parameters following regression lines were plotted. Similar study conducted by Subramani *et al.* (2012) found decreasing noise level with increased atmospheric temperature.

Table 3. Comparison of noise pollution in different cities of Bangladesh

City	Noise Level (dB)	References
Dhaka	80.56	Present study
Dhaka	77.50	Cowdhury <i>et al.</i> (2010)
Tangail	78.32	Hoque <i>et al.</i> (2013)
Sylhet	86.83	Amin <i>et al.</i> (2014)
Rajshahi	57.3-102.2	Bari <i>et al.</i> (2017)
Mymensingh	86.5-106.5	Islam <i>et al.</i> (2016)
Khulna	62.97	Hoque <i>et al.</i> (2011)
Jamalpur	70.21	Shahadat <i>et al.</i> (2015)

Comparative study shows that noise level is an increasing trend in case of Dhaka city as in 2010 noise level was 77.50dB but present study measures 80.56dB. The results also found that noise level in Khulna, Jamalpur, and Tangail were much better than Dhaka city (Present study). Noise pollution status of Sylhet city is more or less same to present study and these noise levels are harmful for human health. However, noise pollution level in Rajshahi and Mymensingh city were worse than Dhaka city (present study) and noise level was much higher than acceptable limit. So, the comparative study revealed that noise level of Dhaka city along with the Rajshahi, Mymensingh and Sylhet were at an alarming level and immediate actions need to be taken to solve this problem.

Conclusion

The results of the study revealed that the noise pollution level in commercial area of Dhaka city is at an alarming state as all the studied locations exceeded the acceptable limit of noise. This might be due to the increasing number of vehicles in roads. Weekends along with the working days were facing severe noise pollution (>70 dB) and their variations were also significant. Study stated that at night average noise level was higher than the day time because of a higher number of vehicles and people crowding at night. Moreover, relative humidity was high at night which may positively correlate with noise level. Thus, the study suggested that it is the high time for government and non-government organizations to work together to reduce noise pollution and increase the quality of life in the Dhaka city.

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