NOISE LEVEL OF IMPORTANT PLACES OF RAJSHAHI CITY

Md. Niamul Bari[1], Md. Shahin[2], Md. Khalid Bin Olid[1], Md. Jamidul Islam[1]

[1]Department of Civil Engineering, Rajshahi University of Engineering & Technology (RUET), Bangladesh.
[2]Dept. of Disaster Resilience & Engineering, Faculty of Disaster Management, Patuakhali Science & Technology University, Bangladesh.

ABSTRACT

Noise, commonly defined as an unwanted sound, is an environmental phenomenon to which human are exposed throughout their life. Noise can also be considered an environmental pollutant. Noise is not simply an annoyance rather a hazard to one's physical and mental well-being. This study attempts to assess the traffic induced noise and suggests some mitigation measures which are likely to reduce the level of noise. The main sources of higher noise level in Rajshahi city due to transportation activities. For this purpose present study was carried out at 10 different important locations with Sound Level Meter to assess the sound level in Rajshahi city. Along with the noise level measurement the traffic volume was also determined at the same time to establish whether any relationship or not. In this study more acute zones which are affected by the sound pollution in Rajshahi city were identified. From the study, it is observed that the maximum noise levels were detected to be 103.5 dB, 105.2 dB, 104.1 dB, 102 dB, 102 dB, 95.5 dB, 99 dB, 99.4 dB, 95.8 dB, 93.8 dB at Talaimari more, Vodra more, Rail station, Rail gate, Kashiadanga, C & B more, Laxmipur more, Monichottor, Saheb Bazer zero point and Alupotti more, respectively. However, more acute zone of Rajshahi city are Bhodra more, Rail station, Talaimari more, Rail gate and Kashiadanga more where noise level is above 100 dB. The study could show any clear relationship between noise level and traffic volume rather it depends upon the whistling of vehicles. These zones are mostly traffic intensive and having always public crowd. The inter district buses are mainly standing in these points to collect passengers and whistling frequently. The study suggested that whistling of the vehicles must be restricted within the city during the collection of passengers.

Keywords: Noise pollution, traffic volume, allowable limit

1. INTRODUCTION

Rajshahi is one of the largest and divisional cities of Bangladesh. With the increasing of urbanization as well as population, the number of industries, market place, crowdie recreational place and even vehicle movement in the city is increased causing sound pollution. Noise is unacceptable level of sound that creates annoyance, mental hampers, physical disorder, stress on the auditory and nervous system and induces severe damage to the health. According to World Health Organization (WHO) statement, noise is considered to be the third most hazardous pollutant in large cities.

The term Noise refers to a sound without agreeable musical quality or as an unwanted or undesired sound. As a result of increasing mechanization, the use of increasingly voluminous and complicated machinery, equipment and the stepping up of the pace of production, the noise is becoming an increasingly widespread and serious source of discomfort and danger (Singh and Dev, 2010). Noise pollution is a significant environmental problem in many

rapidly urbanizing areas. This problem is properly not recognized despite the fact that it is steadily growing in developing countries (Barboza, 1988). At present, noise pollution is considered as 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 **(**Martin, et al., 2006).

The major sources of noise are industries, vehicles and airplanes and construction and demolition works. Among the sources vehicular noise is most common for all classes of cities. The major factors influencing the generation of road traffic noise are traffic flow, traffic speed, proportion of heavy vehicles, gradient of the road and nature of the road surface (Williams and McCrae, 1995). Furthermore, the increase in magnitude and severity of traffic noise depends on population growth and urbanization (Bjork, *et al.,* 2006).

Like other developing counties, different cities of Bangladesh are also facing the hazard of noise pollution severely. About five to seven percent of the patients admitted to the Bangabandhu Seikh Mujibur Rahman Medical University in Dhaka are suffering from permanent deafness due to noise pollution and hearing ability of the inhabitants of the City (Ahmed, 1998). A survey conducted by the Department of Geography and Environment of Jahangirnagar University among 100 people (doctor, traffic police, driver, teacher, student, businessman and service holders in 2001-02) showed that all of them were invaded with diseases due to excessive exposure of noise pollution (Ayaz1 and Rahman, 2011). The diseases which attacked among 100 people were as bad headache is 11.17%, temporary hear loss is 12.31%, fatigue is 17.58%, insomnia is 14.36%, irritability is 27.57%, hear diseases is 25.80%, and others is 2.64%.

Therefore, investigation to determine the noise level in various cities is essential to be carried out for setting the safety measures. Rajshahi is one of the largest divisional cities in Bangladesh that might suffer from the pollution of noise adversely. An attempt has been taken through this study to investigate the sound intensity at important road intersections of this city and to identify the most acute zone of sound pollution and provide solution based on effects. The outcomes of this study might be helpful to design the traffic flow system as well as urban planning of this city.

2. METHODOLOGY

Rajshahi is not an industrialized city. However, being a divisional city it is mainly connected with different districts, divisions and capital by road network. Huge numbers of motorized vehicles are passing everyday through the city. Motorized vehicular sound is considered to be a major source of noise in Rajshahi City. Therefore, ten important road intersections are selected as study points.

A portable digital sound level measuring instrument is used to record the continuous highest and lowest sound levels. The highest and lowest sound levels are recorded at every 15 minutes interval in decibel unit. The field study is conducted in two working days and one holyday for 11 hours from 8 AM to 7 PM. The average of maximum and minimum noise levels with their standard error are calculated and plotted in normal graph paper with respect to time. The numbers of vehicle are also counted within each time span of sound level measurement.

2.1 Site Selection

The site selection is done in such a way that almost all important road intersection can be covered considering maximum vehicular passing, surrounding locality, important institutions,

station, junction, commerce and offices, etc. so that the scenario of noise pollution of important road intersection in Rajshahi city could be reflected. Among the selected road intersections, three entry points of Rajshahi city from Dhaka through Natore district, Naogon district and Chapai Nawabganj district are Talaimari more, Rail gate (Bindu more) and Kashiyadanga, respectively. Bohodra more is the intersecting point vehicles coming from two bus stands of Rajshahi city and besides the Rajshahi University of Engineering & Technology as well as Padma residential area. Rail station more is important point for the situation of railway station, inter district bus station and Dhaka bus terminal which is one of the most crowded place. Alupoti more, Zero point and Monichottor are the three important points within the heart of the city, Laxmipur more is near the Rajshahi Medical College Hospital which is also surrounded by numbers of private clinics and diagnostics centers. The C&B more is the intersection point of three important roads coming from Rajshahi Medical College Hospital through Laxmipur, from Circuit house and PWD office and from Saheb Bazar. All these areas constitute the major commercial, social, educational and other activities in the city. Ten important places of Rajshahi city are shown in Figure 1. The latitude and longitude of these points are given in Table 1.

Figure 1: Ten road intersection points in study area of Rajshahi city

Table 1: Latitude and Longitude of ten road intersection points

SL. No	Location	Latitude	Longitude
1	Talimari More	24°21′44.39″	88°37′35.06″
2	Bhorda More	24°22′31.94″	88°36′54.44″
3	Rail Station	24°22′29.67″	88°36′30.35″
4	Rail Gate (Bindu more)	24°22′28.32″	88°36′14.00″
5	Laxmipur more	24°22′18.29″	88°34′56.97″
6	C & B More	24°22′05.70″	88°34′50.99″
7	Alopurtti More	24°21′41.36″	88°36′46.90″
8	Saheb bazer zero point	24°21′53.43″	88°36′00.37″
9	Monichottor More	24°21′58.43″	88°35′46.53″
10	Kashiadanga More	24°23′07.99″	88°32′50.22″

2.2 Equipment: Digital Sound Level Meter

A digital sound level meter is used in this study. It is an instrument to measure sound pressure level in decibels (dB). This meter is featured with wide measuring range from 30 dBA to 130 dBA with accuracy level of ±1.5dB, digit and resolution of 4 digits and 0.1 dB, frequency response of 31.5 Hz-8.5 KHz, sampling rate of 2 times/s, automatic backlight display, maximum value hold, low battery indication, auto power off, power supply by 9V battery operation. The country of origin is China. This is a portable instrument easy to use and handle for sound intensity measurement. This equipment has been designed to meet the measurement requirement of safety engineers, health, industrial safety offices and sound quality control in various environments, which include factory, office, traffic, family and audio system. It is also used in noise pollution studies. The Figure 2 represents the digital sound level meter used in this study.

Figure 2: Digital sound level meter

2.3 Operational Procedure

A 9 V lithium battery is connected in the battery chamber. 'ON' button is pressed to turn on the unit and the LCD displayed full screen for 1 second. Then it starts to measure the current sound level. The button 'MAX' is pressed to lock the maximum sound level, the sound level will be locked until the higher value appears to replace. The minimum value is recorded within the time span that will not be locked. By pressing 'MAX' button again the unit will go back to the standard measurement mode.

2.4 Traffic Volume Analysis

The numbers of each type of motorized vehicle passed the intersection are counted in each 15 minutes time interval. Traffic volume was calculated with the collected data by using the following equation suggested by IRC. The average traffic volume with its standard error is calculated and presented by graphical plotting.

Traffic volume =3(number of buses + number of trucks) + number of cars + number of power trailers (pcu/15min)

3. DATA COLLECTION AND ANALYSIS

Noise level data were collected from the study zone using noise meter directly in decibel (dB). At first the equipment was calibrated. The vehicles were classified as a three categories such as bus and truck, car and micro-bus, and power trailer. The maximum and minimum sound levels in decibel are recorded and the numbers of vehicles are counted within each time span.

The maximum and minimum sound levels recording and vehicle counting are started at morning from 8 AM for every 15 minutes intervals to 7 PM. The data is collected for three days. The traffic volume is determined in terms of PCU per 15 minutes. The average values of traffic volume as well as the maximum and the minimum sound levels are plotted with their standard deviations in the Figure 3 to 13 for ten selected points.

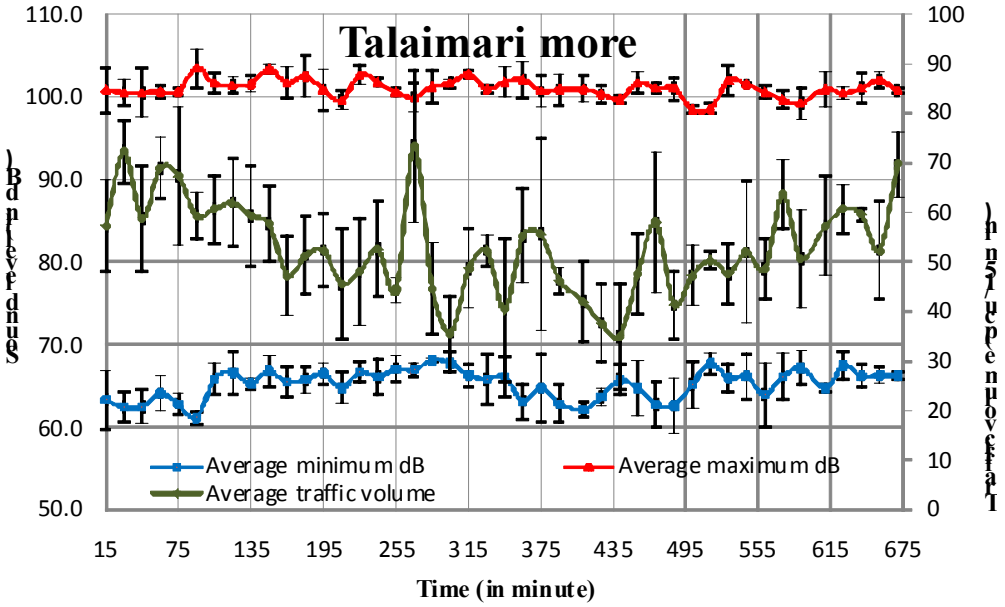

Figure 3: Sound level and average traffic volume with respect to time at Talamari

Figure 3 showed that the maximum noise level is above the 100 dB and minimum noise level varies from 60 dB to 70 dB at Talaimari road intersection. The minimum sound level is fluctuating in course of time. The average minimum sound level is higher from 9.30 AM (90 minutes) to 1.45 PM (345 minutes) and from 4.30 PM (510 minutes) to 7 PM (650 minutes). However, the average maximum sound level is almost uniform and it is not dependent on the traffic volume rather horning of vehicle. The minimum sound level is fluctuated due to might be the variation of various activities at the intersection. Because, the maximum traffic volume is counted at morning time and at evening time. The departure of the long distance passenger buses from Rajshahi during morning time and arrival at evening time are more compared to other time of the day those are passing this intersection.

The maximum and minimum noise levels recorded at Bhodra road intersection are similar to Talaimari intersection (Figure 4). Figure showed that the noise level is not the maximum when the traffic volume is the maximum. However, the traffic volume is higher at Bhodra intersection than the Talaimari intersection which is varying from 60 to 80 pcu/15 minutes from morning to afternoon and above 80 pcu/15 minutes at evening time. This is might be due to the different day of data collection.

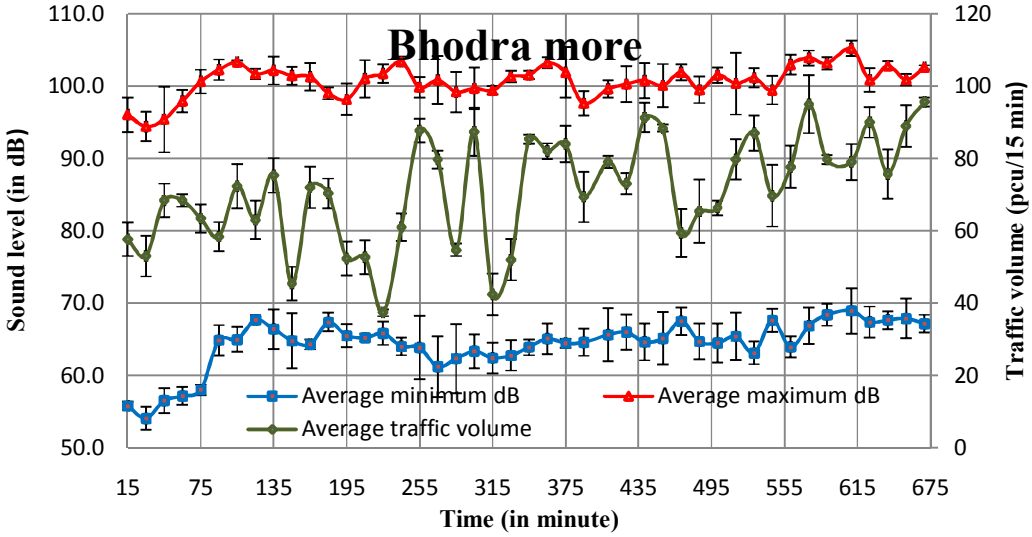

Figure 4: Sound level and average traffic volume with respect to time at Bhodra

The traffic volume variation at Rail station intersection is similar to Talaimary intersection but it is varying mostly from 45 to 60 pcu/15 minutes (Figure 5). The maximum and minimum sound levels are almost uniform during the study time except at morning from 8 AM to 9.30 AM which is lower than the rest of the time. The maximum noise level is about 150 dB while minimum noise level is about 67 dB. The high level of noise at this point is due the continuous departure and arrival of inter district bus as well as Dhaka going coach.

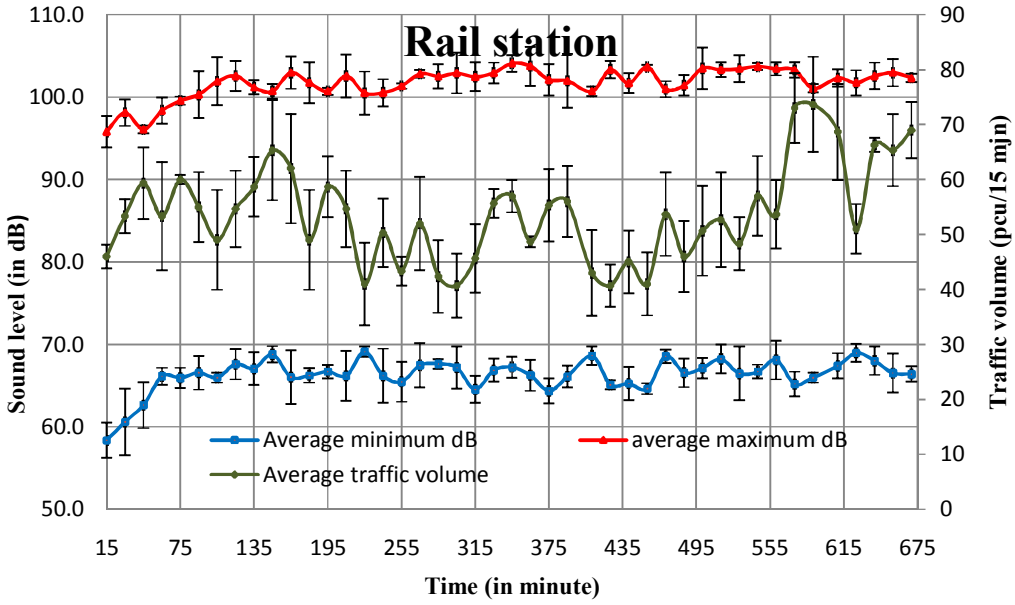

Figure 5: Sound level and average traffic volume with respect to time at Rail station

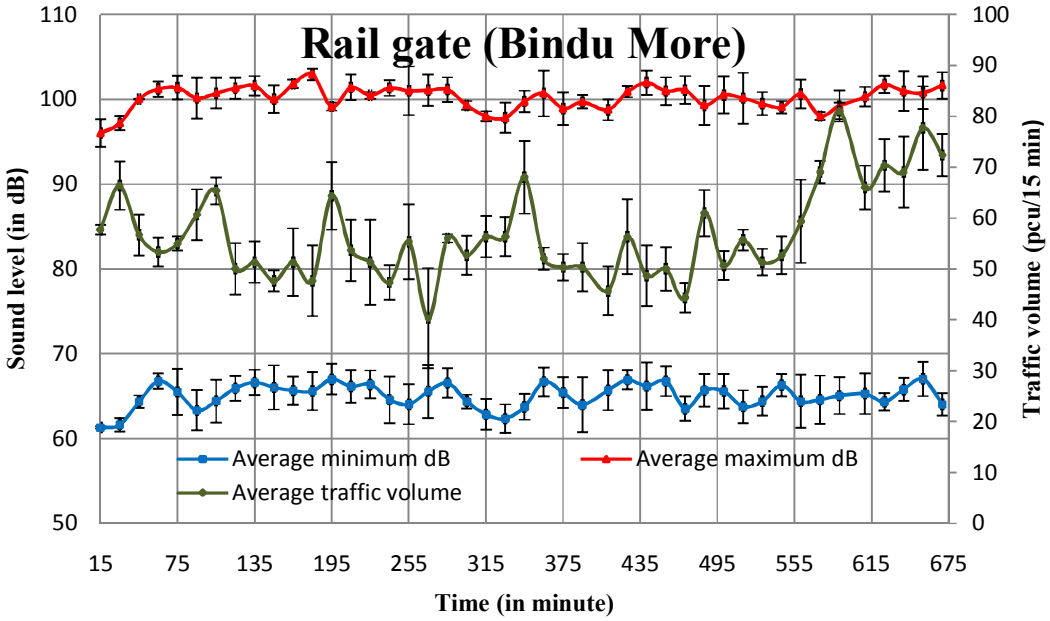

Figure 6: Sound level and average traffic volume with respect to time at Bindu more

The Figure 6 shows that the maximum noise level is slightly above the 100 dB and minimum noise level is within the 62 dB to 67 dB at Rail gate (Bindu more). The traffic volume variation is same as the Rail station intersection and increased during the evening time. As like as other intersection the noise level could not be related with the traffic volume.

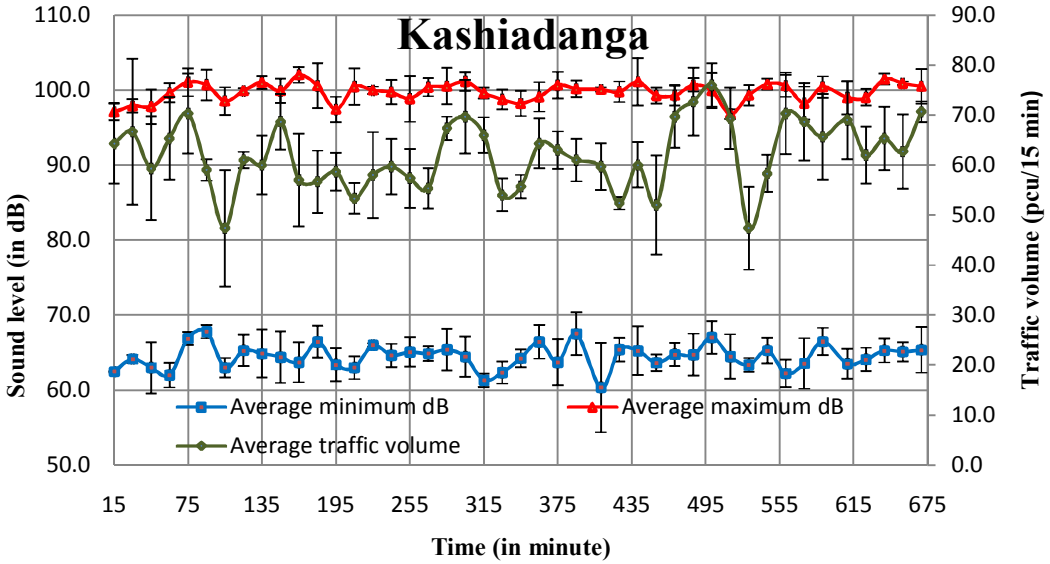

Figure 7: Sound level and average traffic volume with respect to time at Kashiadanga

The maximum noise level at Kashiadanga is about 100 dB and minimum noise level is below the 70 dB. The both noise levels are uniform throughout the day. The traffic volume is varying within 50 to 70 pcu/15 minute and fluctuation with time is not remarkable (Figure 7).

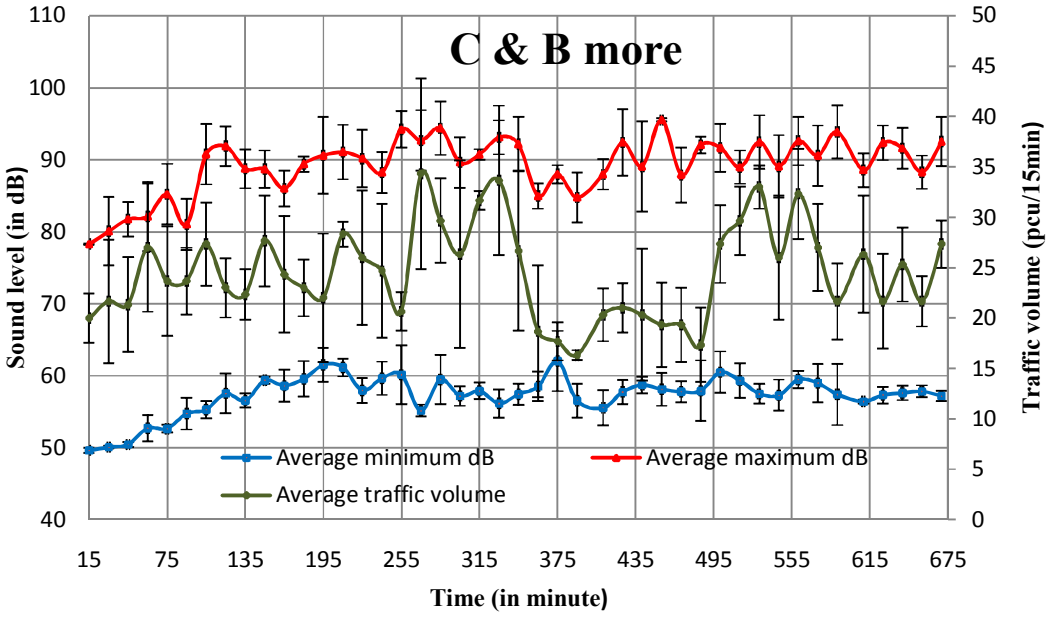

Figure 8: Sound level and average traffic volume with respect to time at C&B more

Figure 8 showed that the maximum noise level is below the 100 dB and minimum noise level is below the 60 dB. From figure it is showed that the traffic volume is not maximum when the noise level is maximum or vice versa.

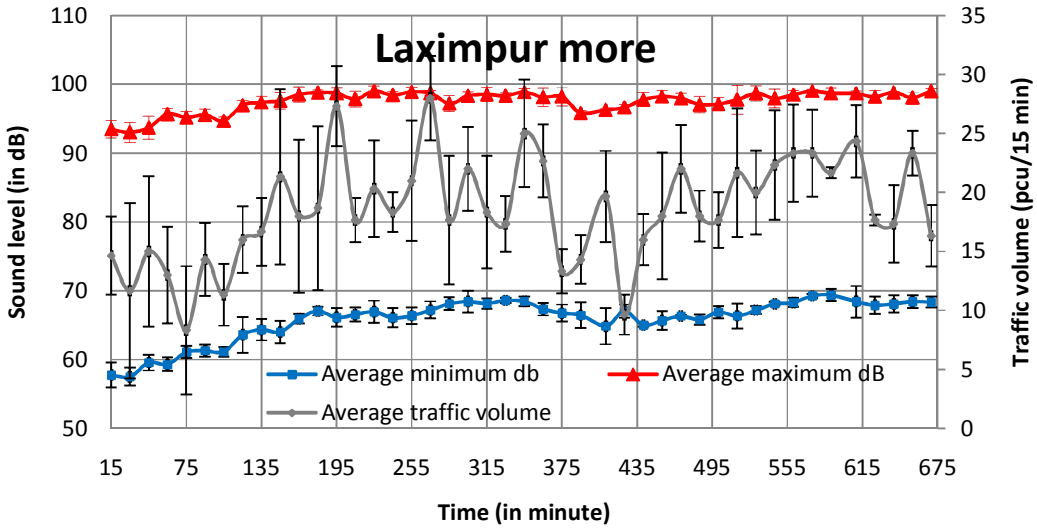

Figure 9: Sound level and average traffic volume with respect to time at Laxmipur more

Figure 9 showed that the maximum noise level is about 92 dB at morning and it is gradually increased to reach the highest level of 100 dB at 10.45 AM it is remain steady up to evening (7 PM) except at noon (from 2 PM to 3 PM). Similarly minimum noise level was recorded starting from 57 dB at morning and it is gradually increased to reach the highest level at 1 PM. At noon from 2 PM to afternoon 5 PM, the minimum noise level dropped from highest level and most of the time it is remain below the 60 dB. From the figure it is clearly observed that the fluctuation of noise level follows the fluctuation trend of traffic volume. The lowest traffic volume was found at morning when noise level was also lower. The traffic volume is varying within 80 to 90 pcu/15 min at most of the time.

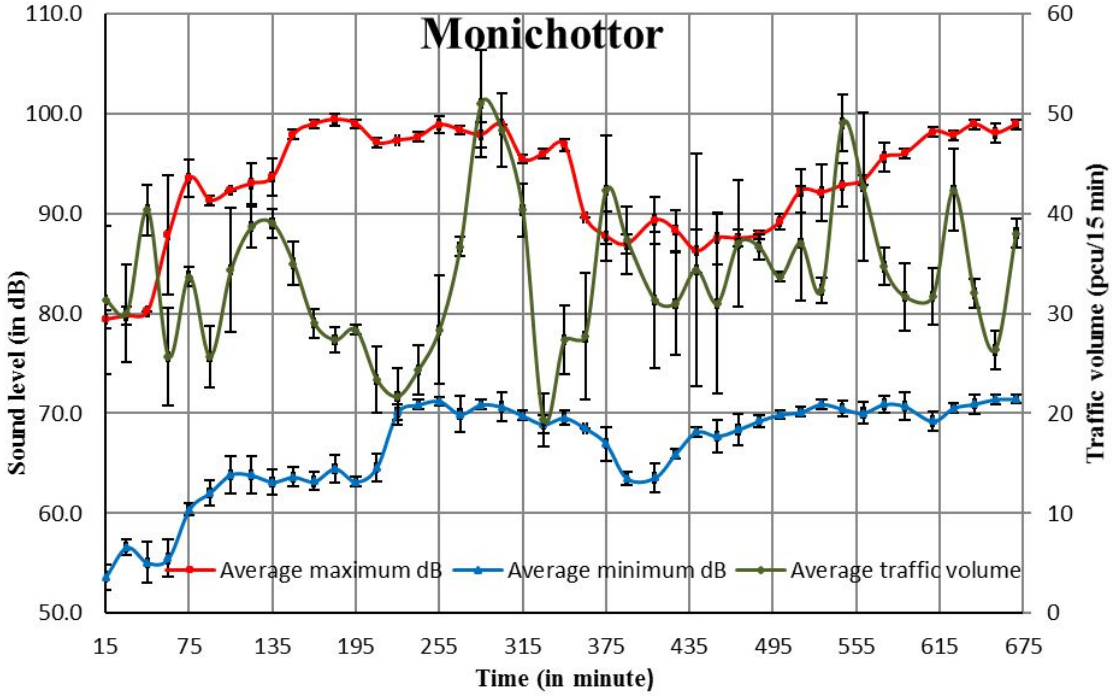

Figure 10: Sound level and average traffic volume with respect to time

The variation of noise level and traffic volume at Monichottor, Saheb Bazar, is shown in Figure 10. The Figure 10 shows that the maximum noise level is about 80 dB at morning 8 AM and sharply increased to about 100 dB at 10.30 AM when all markets are started to run in full swing. It is again gradually dropped to 85 dB at noon and start to increase gradually to reach at maximum level at afternoon when maximum buyers are at market. The minimum noise level is also follows the same trend and maintained almost steady condition at 70 dB at most of the time. The traffic flow pattern is very erratic at Monichottor. The noise level is not consistent with traffic volume variation trend.

The study point Monichottor and Saheb Bazar Zero Point are bearing same physical characteristics and surrounding conditions. The noise level variation and traffic volume pattern is presented in Figure 11. The Figure 11 shows that the maximum and minimum noise levels are following same patterns as Monichottor. However, the maximum noise level is about 95 dB. On the other hand, the minimum noise level is same as Monichottor of 70 dB. The maximum or minimum noise is not depending upon the traffic volume but it is depending on horning of vehicles and gathering of huge people.

Alupotti more is one of the important locations of Rajshahi city which is the entry point of Saheb Bazar. Almost all the vehicles entering through the alupotti more are passing the points Saheb Bazar Zero Poit and also Monichottor. Therefore traffic flow patterns should be same for these three points. However, the traffic volume of these three points differs because of the collection of data in different days. The variation of noise level and traffic volume is shown in Figure 12.

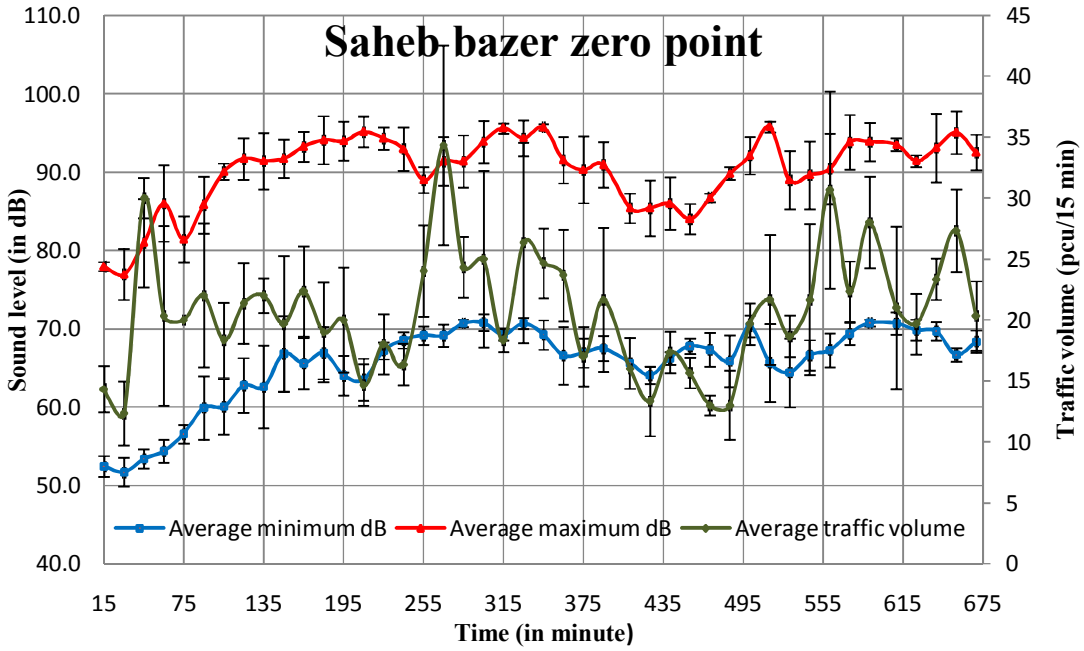

Figure 11: Sound level and average traffic volume with respect to time

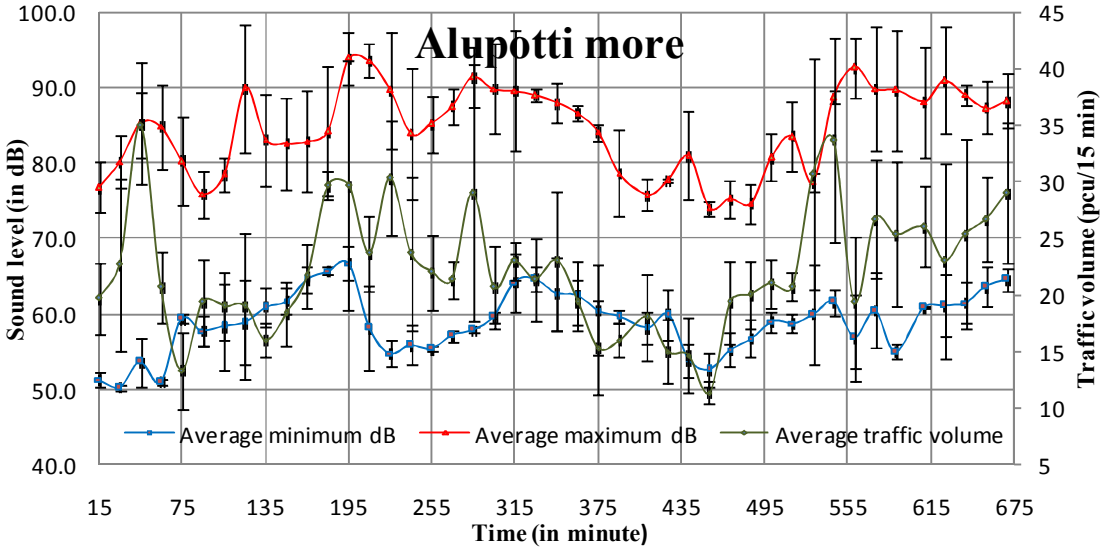

Figure 12: Sound level and average traffic volume with respect to time

The Figure 12 shows that the maximum noise level is crossed the level of 90 dB only for four times. Most of the times maximum noise level is below the 90 dB and minimum noise level is below the 60 dB.

4. RESULT AND DISCUSSION

The maximum noise levels at selected study points are determined from the above analysis of the collected data. Figure 13 and 14 depicts the relative status of the selected study points for their maximum and minimum noise levels. The highest noise was found to be of 105.2 dB at Bhodra more and the lowest was found to be of 93.8 dB at Alupotti more. The noise levels at Bhodra more, Rail station, Talaimari more, Rail gate and Kashiyadanga are above 100 dB

while at Monichottor, Laximpur more, Saheb bazer zero point, C&B more and Aluporti are below 100 dB.

From this study it was found that the commercial vehicles such as buses and trucks pass through the Talaimari more, Bhorda more, Rail station, Rail gate and Kashiadanga. In the Talaimari zone the maximum decibel was 103.5 dB. As a consequence of this phenomenon, the noise levels exceeded 100 dB of these five points. One the other hand, the noise levels in other five points are nearly 100 dB.

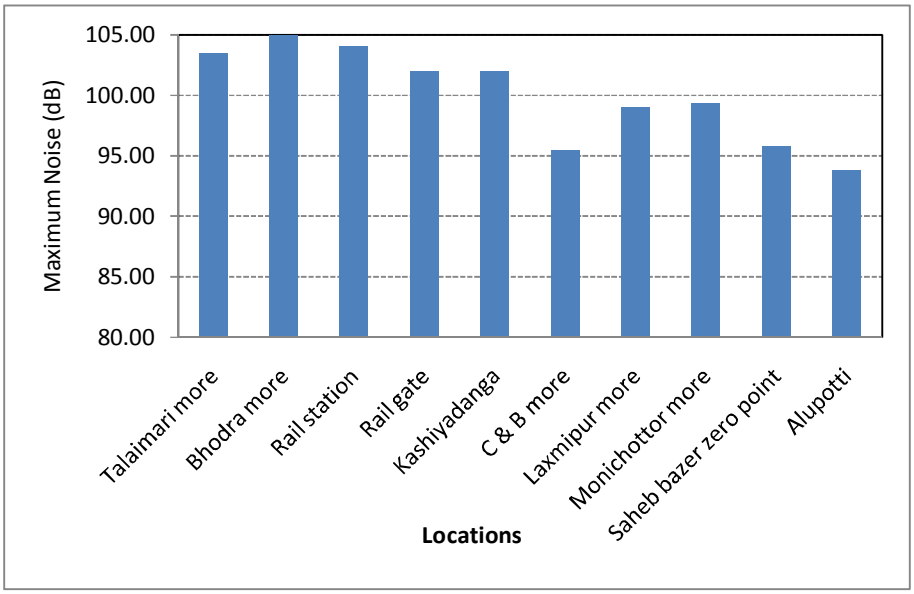

Figure 13: Average maximum noise level at different points

The average minimum noise level exceeds 65 dB at Talaimari more, Rail station, Monichottor, Laximpur more and Saheb bazer zero point but noise levels at all points exceed 60 dB except at C&B more and Alupotti more. The lowest average minimum noise of 57.27 dB was measured at C&B more.

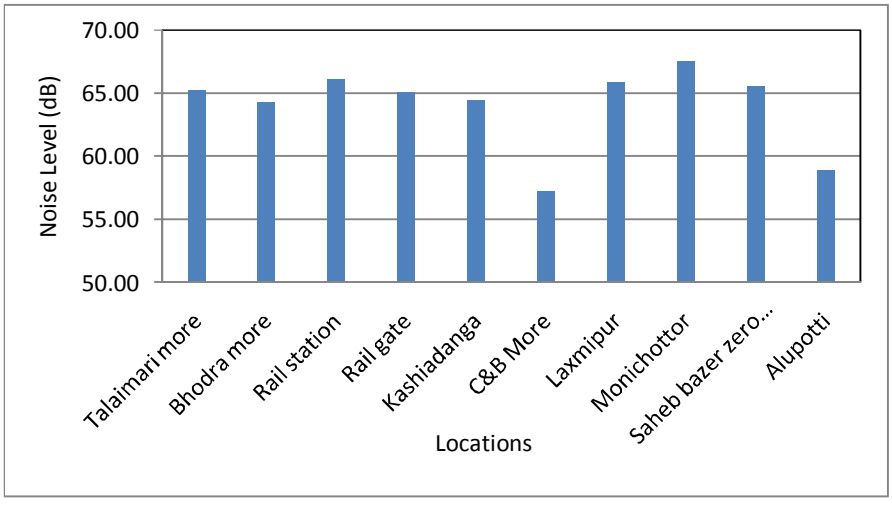

Figure 14: Average minimum noise level at different points

The acceptable noise levels for different areas recommended by Bangladesh Department of Environment (DOE) are shown in Table 2.

Table 2: Acceptable noise level for different areas (Ashish et al., 2015)

Case	Description of area	Noise level dB	
		Day time	Night time
i	A sensitive area where quietness is of primary importance such as schools, hospitals, mosques etc.	45	35
ii	Residential areas	50	40
iii	Mixed areas, which are, used as residential areas as well as commercial and industrial purposes.	60	50
iv	Commercial areas	70	60
v	Industrial areas	75	70

According to Bangladesh standard the maximum noise level for all study points are much higher than the allowable limit of 70 dB at day for commercial area and even industrial area of 75 dB. On the other hand, average minimum noise level is also much higher than the allowable limit for residential area and sensitive area in all selected study points.

Among the selected study points, Bhodra more, Talaimari more, Kashiyadanga, Rail gate, Rail station, C&B more and Aluporti are falling under case iii (Mixed areas, which are, used as residential areas as well as commercial and industrial purposes) while Monichottor and Saheb bazer zero point is under case iv (Commercial area). However, Laximpur more is surely under case i (A sensitive area where quietness is of primary importance such as schools, hospitals, mosques etc.)

According to DOE, considering the all cases, the maximum noise level in the study area is highly greater than the acceptable limit. The analysis regarding maximum, average and minimum noise level with respect to acceptable limit showed that almost all the places are at alarming conditions in case of noise level.

5. CONCLUSION

From the present study it was found that the maximum value of noise at the 10 study points ranged from 93-105 dB. Analysis showed that all places exceeded the acceptable maximum noise limit. Bhodra more, Rail station, Talaimari more, Rail gate and Kashiyadanga are the most acute zone which is affected by the noise pollution in Rajshahi city. Although other places are also suffering for excessive noise pollution. Therefore, immediate necessary action must be taken by the authority to improve the situation.

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